EXAMINING SUCCESSFUL BUS RAPID TRANSIT (BRT) IMPLEMENTATION MODELS TO DEVELOP A PRE-IMPLEMENTATION EVALUATION CRITERION (PIEC): AN APPLICATION TO FT. COLLINS, COLORADO AND GAINESVILLE, FLORIDA

By

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A THESIS PRESENTED TO THE GRADUATE SCHOOL OF THE UNIVERSITY OF FLORIDA IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF ARTS IN URBAN AND REGIONAL PLANNING

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To my mother and father, for all their support

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in the nation, but I have also gained some life-long friends through my time in this program and I will never forget my experience here.

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LIST OF ABBREVIATIONS

APTA	American Public Transportation Association
BEBR	Bureau of Economic and Business Research
BRT	Bus Rapid Transit
BRTS	Bus Rapid Transit Systems (Gainesville)
CBD	Central Business District
CUTR	Center for Urban Transportation Research
EmX	Emerald Express System
FTA	Federal Transit Administration
FY	Fiscal Year
GPS	Global Positioning Systems
GAO	General Accounting Organization
LRT	Light Rail Transit
MAX	Metro Area Express
RIT	Rede Integrada de Transporte
RTS	Regional Transit Systems
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users
TCRB	Transit Cooperative Research Board
TOD	Transit Oriented Development
TRB	Transportation Research Board

Abstract of Thesis Presented to the Graduate School
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With the population ever-increasing, gas prices on an upward climb, and citizens tightening their belts due to the current economic downturn, this is the most opportune time to look at alternative types of public transportation, with Bus Rapid Transit (BRT) being at the forefront. The implementation of BRT is a process that must be seriously scrutinized and thoughtfully planned out, but when applicable under certain conditions, the cost-benefit analysis favors BRT over any other form of mass public transit.

This thesis project aims to develop the necessary pre-existing conditions and policies a municipality must have in place prior to implementation of a BRT system. These guidelines ensure that the BRT system will run efficiently, maintain a purpose, and will ensure the system can sustain itself once it is implemented into the existing transportation network. Several thriving BRT models will be examined and the principles they used will be applied to two existing cities that are proposing BRT within the confines of their existing transit systems.

The two cities that were chosen for this study are Ft. Collins, Colorado, and Gainesville, Florida. These cities will be compared and contrasted based on BRT planning practices used. They each have similar demographics as far as population size, total encompassing area, and both are home to major state universities, yet they both possess unique qualities that have been successful over time.

The objective of this thesis is to formulate a pre-implementation evaluation criterion (PIEC) for BRT. It is essential that a list of determinants is recognized, so that a template can be produced and followed. Relevant literature on this topic has been thoroughly researched and compared with three flourishing BRT models of implementation: Curitiba, Brazil, Bogotá, Colombia, and Eugene, Oregon. These cities have shown the ability to sustain BRT over an extended period of time, in this case, greater than a year, and are routinely viewed as model systems. Once pre-existing determinants are recognized, they will be applied to Ft. Collins and Gainesville to determine whether either city or both is suitable to implement and sustain BRT in the long term.

CHAPTER 1
INTRODUCTION

In a time when government is continuously searching for ways to improve the transportation infrastructure and mobility in this nation, BRT presumes to be a viable solution as we move forward with innovative methods of transportation planning. When a city decides to pursue BRT capital funding, it will need federal, state and local sources at its disposal. Private financing schemes, and locally applied taxing policies are additional methods of funding. Although BRT costs considerably less than a typical mass rapid transit system, municipalities normally must secure several funding sources to meet project budgetary needs (FTA 2010). Currently, almost all of the United States BRT systems and rapid bus capital projects have been built through federal grants combined with state and local matching funds (FTA 2010). Few cities have allocated state and local funding solely for this purpose. Private financing by investors is not a customary practice for paying for BRT, but it may present cities an innovative alternative to the traditional government grant process (BRT Policy Center, 2010).

The goal for transit within municipalities should be to maximize the potential of the urban space (Newman and Kenworth, 2003). This can be accomplished by adapting and improving upon successful transportation models already in existence, models such as those in Curitiba, Brazil, Bogotá, Colombia and Eugene, Oregon (BRT Policy Center, 2010). These cities have been at the forefront of BRT research and experimentation for the last two decades. By observing and studying past practices, while at the same time incorporating the ever changing transportation policies, a municipality can attain successful implementation of BRT.

A significant characteristic of BRT is its symbiotic relationship with the surrounding land use. In order for BRT to truly be efficient, it should be integrated with land use. This will assure that BRT is utilized to its full capacity, thus creating a hub for economic development along the transportation corridor. Like any large scale transit project, BRT will need one or more sources of funding for implementation, and a large portion of that funding will come from governmental grant programs. The competition for these federal grants is heated, due to the increased number of cities in search of substantial funding sources. If this money is to be used as efficiently as possible, a pre-implementation evaluation criterion (PIEC) should be determined from existing successful BRT models. Municipalities will then have a basic template to follow when carrying out large-scale and innovative transit improvements.

Problem Statement

Over recent years, an increasing number of communities have initiated the search for alternative forms of public transportation to address issues of excessive population growth and lack of transit mobility/flexibility within the present street network (Newman and Kenworth, 2003). Yet, there is currently no tangible process for determining whether or not BRT can be applied effectively to all municipalities that seek to use it. Gainesville, Florida, and Ft. Collins, Colorado are two such cities (City of Gainesville and City of Ft. Collins, 2010). In each, suitability studies as well as cost-benefit studies have either been completed or are currently underway (City of Gainesville and City of Ft. Collins, 2010). This is to determine the long-term efficiency of BRT within each municipality by weighing every nuance that may impact its success (Levinson, H., Zimmerman, S. and S. Danaher, 2004).

An often overlooked and rather crucial aspect of BRT studies in determining suitability for any city is the existing policies and conditions of the prospective BRT municipality. Many communities who wish to implement BRT within their city, but they do not have the infrastructure in place to support, much less sustain such a high occupancy mode of transportation. Something as simple as a poor street layout can minimize the success of BRT.

Successful case studies must be applied, but should not be used to speculate that there is a universal solution, because this is clearly not the case. Curitiba, Brazil, for example, is a thriving metropolis that encompasses a much larger transportation network than that of Eugene, Oregon. Yet both cities were able to effectively incorporate BRT into their existing transportation network (Levinson, H., Zimmerman, S. and S. Danaher, 2004).

The key to understanding the applied use of BRT is to truly understand what makes BRT successful. By using successful case studies, with differences as prominent as the similarities each possess, one can extract a desired and necessary criteria for the creation of BRT. Since BRT is a relatively new concept for the United States, pre-implementation criterion is not well established. . So, for a universal methodology to not have already been applied nationwide is understandable.

Nevertheless, there remains a misconception by many planners and transportation planning experts alike, that “if you build it, they will come.” This type of flawed logic, however will only lead to investments in projects that are economically unsound and likely to fail. BRT will not be appropriate for all communities; each project requires scrutiny before any investment of funds and resources is made. As this study

will show, certain conditions should be in place for implementation to be carried out successfully.

Aside from the significant investment of time, money and resources required for BRT, an additional aspect that must be accounted for is the often negative stigma that has attached itself to public bus transit in the United States (Newman and Kenworth, 2003). Many believe that the bus is dirty, only intended for the lower class, a haven for crime and gangs, it never runs on time and that it is always overcrowded (Newman and Kenworth, 2003). In order to sell the concept to the public an aggressive advertising campaign should be part of the overall plan. Many believe that the city should adjust to a new transit system, but in reality BRT should be constructed in a way that fits to the city's already existing infrastructure, with minimum disruption to everyday operations. These misconceptions surrounding BRT persist and that is why there is such a pressing need for the establishment of a universal criterion for municipalities to follow. In the end, BRT would benefit all concerned, especially public officials, if they simply implement the "tried and true" methodology of those who have already successfully incorporated this ideal into their community. Thus, they would avoid the costly shortfalls of a major planning nightmare.

Significance of Study

This thesis contributes to the greater understanding of necessary, existing conditions required prior to implementation of BRT. By examining case studies that have successfully and efficiently used BRT, this research study can then concentrate on why these municipalities have succeeded in their utilization of BRT. Curitiba, Brazil, Bogotá, Colombia, and Eugene, Oregon, are dissimilar in geographic size, population, and existing road infrastructure, yet they have all been able execute and sustain BRT

for an extended period of time and are viewed by many planning experts as having created a superior application template (TCRP, 2010).

This study intends to examine the conditions municipalities must have in place prior to BRT implementation. Once desirable pre-conditions are known and extracted from successful systems, the Pre-Implementation Evaluation Criterion, or (PIEC) will be applied. In order to truly test this PIEC, it must be applied to prospective BRT municipalities. After careful consideration of numerous municipalities, Ft. Collins, Colorado, and Gainesville, Florida will be used for the application of the PIEC. These two sites are strongly considering the future use of BRT and have preliminary planning currently under way. This will allow for a full demonstration of just how important necessary pre-implementation conditions are to a viable BRT system.

Organization of Study

The following study uses the descriptive case study method to assess the BRT models of Curitiba, Brazil, Bogotá, Colombia, and Eugene, Oregon, Chapter 1includes a brief topical overview of this study and a description of the three successful BRT models. In Chapter 2, BRT is defined and distinguished from other forms of mass transit (i.e. light rail, express bus). A review of background literature with definitions, examples, and theoretical exploration of BRT is used to provide context.

Chapter 2 will review literature on the following topics, which will lead to the formulation of a pre-implementation methodology: Transit Oriented Development (TOD) and its relationship with BRT, the importance of concentrated population densities surrounding BRT, past BRT marketing campaigns, the incorporation of intermodalism with BRT, the adaptability of existing road infrastructure to support BRT, funding sources used for BRT (FTA's New Starts, Small Starts, and Very Small Starts), the

FTA's specific criterion for BRT systems, the significance of population trends in determining necessity of BRT, and lastly the value of an already successful public bus system being present before implementation. Chapter 3 will be used to clearly define the methodology used for this study. These aforementioned topics that were discussed in the literature review will be analyzed individually, so that the significance and importance of each condition can truly be conveyed. In Chapter 4, after a careful review and analysis, significant findings will be discussed. Chapter 5 will attempt to draw rational conclusion from all aggregated data pertaining to BRT. Ultimately, this study will address the question, "How adaptable are successful BRT implementation models in determining pre-implementation criterion for Gainesville, Florida and Ft. Collins, Colorado"?

Case Study Context

This study will discuss BRT implementation of: Curitiba, Eugene, and Bogotá and two experimental/comparative case studies: Gainesville, Florida and Ft. Collins, Colorado. Curitiba, Paraná is located in the southeast region of Brazil and is said to be the "pioneering city for BRT." It is heavily populated metropolis with over one million inhabitants. By contrast Bogotá, Colombia, lies in the northwest region of South America and is home to over 8 million people. Bogotá is also one of the most technologically advanced countries on the continent. Currently, one of the leading examples for small-scale BRT is formed in Eugene, Oregon (Levinson, H., Zimmerman, S. and S. Danaher, 2004). This city is located in the Northwestern section of the United States, currently has a population of approximately 200,000, people and is roughly the size of Gainesville, Florida (City of Eugene, 2010).

BRT Model One: Curitiba, Brazil

Curitiba is situated in the State of Paraná, in southern Brazil (Figure 1-1). It boasts a population of approximately 1.8 million people and has been at the forefront of BRT innovation since the systems inception. Over the last thirty years, an accelerated population growth has caused the city of Curitiba to expand its municipal boundaries. The city is comprised of an eclectic urban mesh in which the transit system extends beyond the municipal boundary. With these circumstances comes the need to integrate the various street networks and public spaces into one single metropolitan design, a daunting task at best.

Curitiba has boldly adopted an innovative approach to transportation policy. Unlike other cities, quality of life and need for efficient transportation has not necessarily been a hindrance to this developmental process. The Rede Integrada de Transporte, (RIT), system Curitiba aids the residents, who benefit from recent developments such as employment opportunities, households, recreation, and other components of a metropolitan city. BRT in Curitiba helps to facilitate all of these aforementioned components. The planning and design procedure of Curitiba's transportation system was efficient in its placement throughout the city (IPPUC, 2007).

Initially, Curitiba conceptualized a BRT system because of the large number of busses in the then-current transit system. The cities sought out ways to improve the already existing bus system. Gradually, advancements were followed by a perpetual long-term plan for BRT. Curitiba subsidizes its current bus system with an economical express route system that formulated bus lanes. In attempts to enhance and further the existing system, additional methods were devised. Subsequently, a surface system came into play that managed to sustain more than adequate class service, in terms of

an effective transportation system, but at a reduced cost. The BRT system contributes an array of perks for the citizens of Curitiba. Furthermore, BRT has notably reduced travel time and advanced facilities (IPPUC, 2007).

Local busses facilitate more passengers per operating miles in comparison with other cities located in Brazil. This substantial use of public transport has become a popular mode of transit, even though Curitiba boasts a tremendous personal vehicle ownership rate. Curitiba has the second highest per capita car ownership rate in Brazil (one car for every three people (BRT Policy Center, 2010). At least 20% of the recent passengers formerly used their personal automobiles for travelling purposes. This has resulted in reduced automobile crowding and traffic jams, which has given way to several cutting-edge transformations within the city such as multifarious downtown streets with ample space for pedestrian malls and shopping destinations.

In a time where the automobile has become a necessity to many, bus transit often falls short of meeting commuters expectations. Citizens living in the United States are more likely to drive five minutes to work then they are to bike or walk. In Curitiba, Paraná, the functionality and integration of the BRT system is quite apparent. In order for BRT to function properly within the city, the users' mindset must be one of acceptance and not of disdain toward the system itself. Currently, 84 cities worldwide have adapted aspects of Curitiba's BRT system to their transportation systems (BRT Policy Center, 2010).

In 1980, Curitiba implemented this system with a population of only 700,000 inhabitants. The city had an above average growth rate at around 6% and 10% in more urbanized areas (IPPUC, 2007). Despite the fact that Curitiba was and still is seen as

the first successful BRT model in the world, there are legitimate flaws with the system. There have been several instances of bicyclists being struck by busses and other automobiles. The reason for this is that bicyclists often try to share their riding space with the busses, dodging in and out of these designated bus lanes. The act is illegal, but rarely enforced by police. Fortunately for the city, they have recognized this problem and have now proposed parallel bike lanes to designated bus lanes. This change is quite apparent in the plans for Curitiba's new Green Line system (Rabinovitch and Hoehn, 1995).

BRT Model Two: Bogotá, Colombia

Bogotá, Colombia, a city of nearly 8 million people, has certainly learned a great deal of its transportation planning from Curitiba (Figure 1-2). Before there was BRT, there were busses and automobiles running side by side in this large metropolitan city. Citizens used the busses, but not as frequently as they do now. The TransMileneo system operating in Bogotá is acclaimed worldwide as a standard for successful BRT, and the system continues to evolve.

Since its inception, this system has reduced the standard commuting time from ninety to thirty-five minutes in Bogotá. Additional benefits of the TransMileneo include an improvement in air quality by 40% and number of accidents reduced by 81% Currently, there are eight lines scattered all through the city. These busses arrive approximately every two to three minutes. In what is certainly a significant amount, one million people use the TransMileneo system every day. It is expected that by the year 2016, TransMileneo is expected to grow to nearly twenty two lines and transport five million passengers a day (Baltes, Cain & Darido, 2008).

TransMileneo has been a success in Bogotá because of governmental cooperation and its acknowledgement of past BRT models. Local and federal government agencies provided the groundwork for implementation years in advance of BRT. Veolia serves as Bogotá's main transportation provider and is also the mastermind behind the project which happens to operate as a section of the complete TransMileneo system. TransMileneo has been able to transform the way in which people mobilize around Bogotá within a short period of time.

The system has spurred urban renewal programs in the city. Before the TransMileneo system was integrated into the city, there were many indicators that BRT was a viable project for the city to undertake. Air pollution became a serious problem throughout the city, and population growth was continuing to exceed existing transit accommodations. At this point it became clear that Bogotá had to do something to meet the needs of this growing population. Instead of looking to light rail or a subway system, the city looked heavily at BRT, due to its overall cost and flexibility.

During this search for a new, innovative, public transit system, Curitiba was one the models that arose. The mayor of Bogotá at the time, Enrique Peñalosa, had a vision of BRT in the city of Bogotá, and after speaking extensively with Jami Lerner, Curitiba's Mayor, he knew it could be done and should be done to advance mobility within the boundaries of the city. Bogotá already possessed the pre-existing infrastructure and population densities in place that would accommodate a mass transit system. At the time prior to implementation, Bogotá's downtown was undergoing major redevelopment. Concentrated densities were present, with major employment and residential hubs facilitating a prospective BRT system. As more buildings were constructed, this in turn

created more opportunities for business, and thus more and more people began to frequent the downtown area.

As previously mentioned, Bogotá already provided a public bus system, but the system was not meeting the needs of the people. The city needed something different, they needed busses that seated more commuters, they needed a faster system, one in which wait-time were seconds and not several minutes long. People became frustrated with the overall efficiency of public transit and demanded more from their city officials. In fact, as time went on without any improvements to the bus system, people just stopped traveling by bus, but this was not due to lack of commuters.

These people were weary of the presumed traffic inconveniences caused by busses. It was this mindset that was so influential, that by the year 1999 bus ridership had plummeted as low as 45% of commute trips. Because of this steady ridership decline in the transit system, the number of automobiles on the roads swelled and led to the beginning of a brutal cycle. A positive trend is forming now in Bogotá, where there are less people using personal vehicles and more people using the city's BRT system (Figure 1-3).

Prior to implementation, Bogotá offered a standardized public bus system. The problem, like for so many busses in the U.S., was that it lacked the appeal of BRT and many people initially failed to take notice. With a persuasive and informative marketing campaign, along with a total makeover of all fleet busses, people began to look at the bus system in a more positive light. Bogota's marketing campaign consisted of informative workshops and advertisements. These campaigns were used to ease the fears and strengthen the arguments for BRT.

In the early 1990s, the city of Bogotá dealt with many issues involving lack of bus ridership. This was even worse for the city because as a direct result, 3,000 road traffic incidents were reported annually prior to the TransMileneo system and caused 800 casualties. The level of pollution was also extremely elevated. The lack of a planned-out, proficient transit system was threatening Bogotá's monetary survival and the municipal area sank into a state of urban disarray (McBrewster, Miller, & Vandrome, 2010).

Bogota recognized what they had in terms of existing resources and infrastructure. They knew they needed to construct a system that would be economically feasible but still offer everything a light rail or subway system could. Building a subway system from scratch required a considerable investment, which the Colombian government could not dedicate to the city. There was a need to identify an alternative project that would be low cost and could become operational quickly; the answer was found in the form of a BRT.

TransMileneo was designed under such constrained circumstances. The system was planned as a part of the ongoing urban renewal program and was the authorities hope to develop an integrated BRT system. There were three objectives given to this project: ease the traffic load in the already congested urban area, encourage people to use the transit system to increase ridership, and improve the performance of the system while addressing the poor image problem as well (Baltes, Cain & Darido. 2008).

For Bogotá, the foremost advantage of the BRT system was the lower cost of implementing the project as compared to the construction of a rail-based system. Bogotá was able to secure a large amount of federal funding to cover the cost of the

initial phase of TransMileneo. The federal grant covered 75% of the project costs, and the remaining 25% was picked up taxpayers and independent donors. Once again, federal funding is the essential element to pre-implementation criterion for mass transit, in this case BRT. The onset of this new transit system proved to be an opportunity to reevaluate the city's transit policy by taking an integrated approach towards the bus services rather than considering it as just a collection of independent bus services. TransMileneo is therefore incredibly dissimilar from the prior, traditional bus services.

Bogotá's mass transit is now characterized as offering a high frequency of bus arrival and departures, operating in corridor dedicated to only busses-only corridor which has been constructed down the middle of main avenues and is separated from traffic by two lanes (Baltes, Cain & Darido. 2008). A key aspect to the planning of this system, and a rather advantageous one, was the fact that the road street width for the proposed corridor was already adaptable to a mass bus transit system. Because the necessary infrastructure was already present, this reinforced the point of city designers, that BRT was the best fit for Bogotá.

Currently the TransMileneo system functions as trunk corridors with the ability to handle high capacities that consist of four lanes. TransMileneo provides two types of services: express bus lines and local services. Express bus lines only stop at certain stations while local services stop at all stations. The stations have been constructed parallel to the running way such that they are elevated so they can be accessed by overpasses and are present no more than 500 meters apart. Like other high traffic volume structures, some of these stations allow passengers to be transferred to feeder busses, which have extended the municipal coverage of the system.

The TransMileneo network shares the characteristics of a surface metro line including air-conditioned busses, floors at the same height level as the platforms, automatically sliding doors on main bus stations, on the bus Global Positioning Systems (GPS), and real-time and automated passenger information. By and large, TransMileneo offers the same efficiency and value of the rail-based system at a lower cost of construction (McBrewster, Miller, & Vandrome, 2010).

Construction of the BRT was scheduled to take place in four stages, starting from 1999 and expected to be completed in 2016. This phased approach to this project has enabled the city to minimize the economic burden of the construction and set detailed deadlines regarding implementation. Throughout the first phase from December 1999 till June 2001, $217 million was invested in constructing running way of 26 miles along with 61 stations (McBrewster, Miller, & Vandrome, 2010). This cost is considerably less than what it takes to construct a light or heavy rail project of the same magnitude.

The District of Bogotá paid for the first phase of the project through a World Bank loan. The average cost, 5.5 million per kilometer for constructing the first phase, was also considerably less than that used for constructing a heavy transit system (McBrewster, Miller, & Vandrome, 2010).The end of the year 2006 marked the completion of the second phase of the project. Another two phases with specific goals and targets are expected to be implemented through 2016 (Baltes, Cain & Darido. 2008).

The district decided in favor of operating contracts with no financial support from the public for managing this system. Seven operators were selected through an official tendering process that are currently providing service at their own risk, based on the

number of busses allotted to them each year. Initially, the operators financed these busses but now they own the vehicles. Veolia Transport currently holds a bulky share in four of these operating companies and 22% or 250 busses of the system are run by it (McBrewster, Miller, & Vandrome, 2010). Based on the number of busses operated, the operating companies have to ensure that their busses cover a certain number of kilometers in a week. The operators are paid based on the fares collected across the entire system. Because of the large number of passengers, TransMileneo has been able to transfer the commercial risk to the operators (Baltes, Cain & Darido. 2008).

BRT Model Three: Eugene, Oregon

Eugene, Oregon is a college town located in the Northwestern region of United States (Figure 1-4). This city has a population of roughly 125,000 inhabitants (City of Eugene, 2010). With a population of that size, it would seem that there is little need for a large-scale mass transit system. However, BRT does not have to exist solely in a metropolis, and Eugene serves as a classic example for this premise. Aside from moving masses of people, there are additional, sometimes more compelling reasons, why BRT can be beneficial to a community. Primary among these reasons is that it provides a viable alternative to the personal vehicle. By constructing this BRT corridor, the City of Eugene sought to limit the amount of automobile traffic to also link economic development with transportation.

Eugene's solution has been to create a small-scale BRT system within the existing transportation network. The Emerald Express (EmX) operates as an extensive system of BRT in urban Eugene. The system is financed and regulated by Lane Transit District (LTD). LTD takes on the responsibility of being the cardinal local authority in terms of transportation within the encompassing Lake County. LTD decided upon the

BRT system after processing a thorough evaluation. Light rail and other transportation alternatives were contemplated in the inspection report. In conclusion, BRT emerged as a befitting choice which suited the needs of Eugene-Springfield in terms of areas and rampant transportation requirements.

Since its inception in January 2007, the EmX system has achieved most of its goals by meeting the city's need for increased ridership. The prior local bus service had commuted a weekday average of 2,700 boardings. By contrast, the new system had so much initial success that daily corridor ridership increased by 100% in the first 17 months since the service began, reaching in excess of 5,400 weekday boardings as of April 2008. The corridor ridership has already far-surpassed the 20-year projection. In stark contrast, LTD's bus ridership had increased by only 4.8% from 2006 to 2007 (Lisa Callaghan Jerram, MTI, 2008).

Based on preliminary ridership data conducted by the Mineta Transportation Institute, as many as 25% of EmX users are new riders, with 16% of riders previously traveling by car. (Lisa Callaghan Jerram, MTI, 2008). The agency has also stated that the EmX systems actually had to add several more busses on many of their local routes to meet increased passenger demand. It is assumed that this increase may simply be because the EmX is free, and in this day and age when the cost to operate a private vehicle is becoming prohibitive, it is by far the smartest choice. LTD reports that the majority riders have possession of system wide passes or have purchased the fare on the local feeder bus (Lisa Callaghan Jerram, MTI. 2008).

Early 2007 brought the launch of The Green Line route, which connected the area of downtown Springfield to downtown Eugene. The route is roughly around four

miles and has ten stops on the way, which also includes the University of Oregon. As displayed in the map below, there are several nodes formed by placing this transit system along such a frequently used route. As development continues to sprawl towards the east and west, the route is expected to grow in length, thus creating additional stops and business hubs along the corridor.

This system already had in place a substantial employment concentration that allowed BRT to flourish. Busses were used in Oregon before the implementation of BRT, but by no means servicing the population it now serves. Less than a year after EmX was implemented, the bus system saw ridership double along the corridor. There is little doubt that Eugene is one of the more environmentally and, one might say, innovative cities in all of the United States. The success of the EmX system can be gauged from the fact that it was given a nomination for the Sustainable Transportation Award in the year 2008 and entertained an esteemed mention as well.

Figure 1-1. Map of Curitiba, Brazil (Source: Google Earth, 2010)

Figure 1-2. Map of Bogotá, Colombia (Source: Google Earth, 2010)

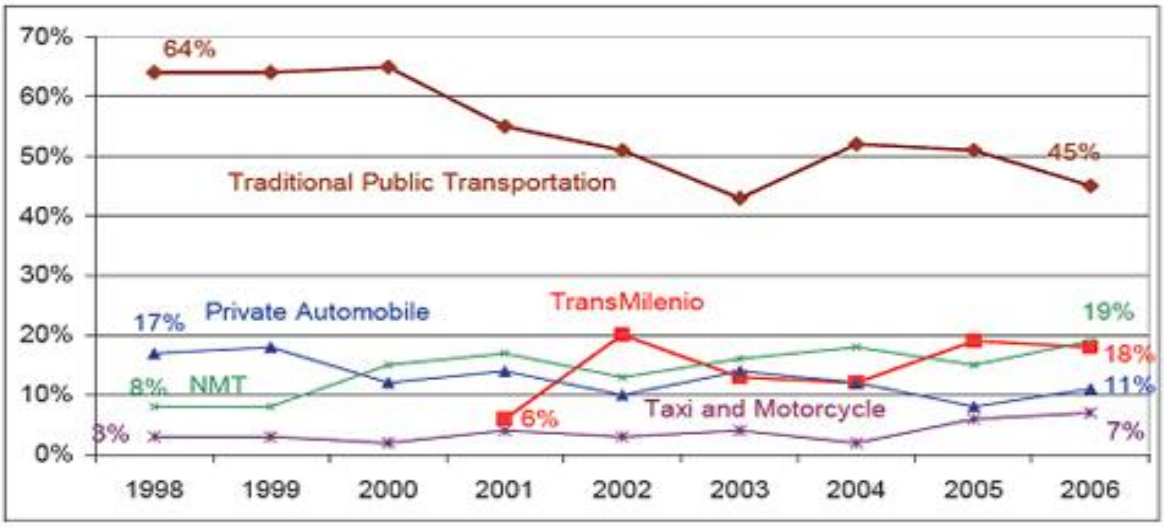

Figure 1-3. Bogotá Trip Mode Distribution Chart (Source: TransMileneo, 2010).

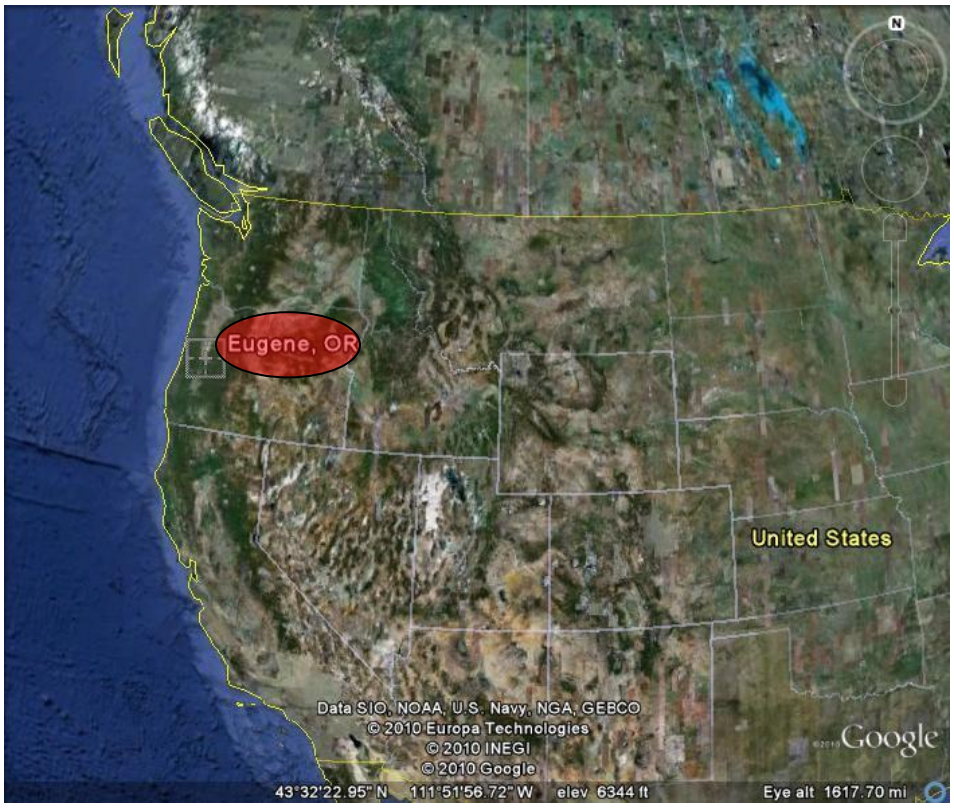

Figure 1-4. Map of Eugene, Oregon (Source: Google Earth, 2010)

CHAPTER 2
LITERATURE REVIEW

Before carefully examining and analyzing model implementation criteria, a review of relevant literature on the intricacies of BRT practices, funding, and appropriate conditions for the system is necessary. Chapter 2 begins with the differentiation of BRT and other modes of mass transportation. In addition, the term transit-oriented development (TOD) is defined to help the reader understand the significance of its usage in relation to BRT. FTA criteria for BRT are discussed in detail, so that a model of conditions favorable for BRT can be formed. Funding sources are discussed, specifically several federal funding programs (i.e. News Starts, Small Starts and Very Small Starts), as well as additional viable sources. The importance of an "intermodalist" transportation network, as it pertains to BRT, will be discussed in detail. Lastly, strategies for successful BRT marketing campaigns are also discussed.

A Comparison of BRT, Standard Bus Transit and Light Rail

The term BRT is defined as an innovative, high capacity, lower cost public transit solution that can significantly improve urban mobility (Neman and Kenworth, 1999). It is flexible, well integrated systems that uses busses on roadways or dedicated lanes to quickly and efficiently transport passengers, while offering the flexibility to meet the transit demand (National BRT Institute, 2010). BRT systems can be customized to fit community needs and incorporate state of the art, low-priced technologies that result in transporting more passengers. (National BRT Institute, 2010).

This system allows busses to flow freely through highways, even when local traffic lanes are congested beyond capacity. A cities' desire to reduce traffic flow for its citizens, along with facilitating economic development opportunities, makes BRT a

palatable option even for those with their own automobiles, as they find that taking the bus is getting them to their destinations much more quickly than in private vehicles.

There is a clear distinction between BRT and standard public bus service and Light Rail Transit (LRT) Standard public bus service does not typically entail a designated lane for commuting, stops are far less closely spaced and wait time for busses is typically 10 to 15 minutes longer than that of BRT (Newman and Kenworth, 2003). Light Rail Transit (LRT) is an effective option for mass transit, but it requires greater investments in the fixed guideway and transit vehicles and the commitment is focused more for the long term.

Both BRT and LRT are intended as a means to spur development. When applied effectively, BRT becomes the more cost effective option of the two. BRT is a public transportation system that has similar riding characteristics to that of LRT, the only significant difference being, LRT uses a rail network, while BRT utilizes a well-engineered street design. (National BRT Institute, 2010). A standard BRT system is created to accommodate its riders with flexible and time-efficient bus routes. One of the core objectives of nearly all BRT planning is a plan for economic development and connectivity throughout the city and in some cases between regions. Municipalities are seeking to not only create a more efficient transportation network, but also to form economic nodes by using a connective BRT system. (National BRT Institute, 2010).

By placing BRT in locations that have significant population density, the system is then put in an optimal position to succeed. If there are large numbers of people using these busses, the not only will they be comfortable with this form of transit, but they will also frequent the shops, restaurants, hotels, and other destinations that will be built

along transit corridors (National BRT Institute, 2010). BRT implementation is also used as a means to spawn new housing development. (National BRT Institute, 2010). This gives BRT yet another purpose, but without the forethought to facilitate these economic nodes the system operates at a minimum efficiency (Newman and Kenworth, 2003).

Connectivity is essential to maintaining and expanding established BRT systems. Implementation of relatively small transit corridors are constructed, some only a few miles long. This serves as the true testing ground for BRT (Newman and Kenworth, 2003). If the system is flourishing, then there is a strong possibility of expansion. This extension of services will ultimately lead to connectivity between other transit modes, such as street car or LRT systems (Newman and Kenworth, 2003). One of the primary reasons behind the establishment of BRT is not just to construct an innovative public bus system; rather it should be used to improve mobility and to promote smart growth (TCRP, 2010).

The Purpose of Mass Transportation Systems

Mass transportation systems are typically used to move large numbers of people from point A to point B (Newman and Kenworth, 2003). (Figure 2-1) Mass transit systems typically take the form of a subway, a light rail system or in some cases a bus system. The term is defined as public transport that comprises passenger transportation services that are available for use by the general public, as opposed to modes for private use such as automobiles or vehicles for hire (Newman and Kenworth, 2003). In the case of public bus systems, they typically use busses on a conventional street network for carrying many passengers on shorter trips. The primary reason mass transit exists is simply to accommodate significant concentrations of population (Levinson, H., Zimmerman, S. and S. Danaher , 2004). When commuters no longer want to put up with

the stress of driving and cost of fuel, that is when mass transit becomes the logical option for many (Levinson, H., Zimmerman, S. and S. Danaher , 2004).

BRT and Transit Oriented Development

BRT works to maximum efficiency only when all contributing factors are in ideal synchronization. BRT is a system best utilized when linked with economic and community development (Levinson, H., Zimmerman, S. and S. Danaher, 2004). As previously stated, BRT is not only seen as a pioneering transportation system, but as a tool used to strengthen economic development. Transit benefits from sustaining and extending the pre-automobile design of American cities; that is, a mixture of land uses within dense corridors simply served by transit lines (Newman and Kenworth, 2003).

Many cities in the United States adhere to certain zoning ordinances and subdivision regulations that do not allow for Transit Oriented Development (TOD) to take shape, not even in areas, typically metropolitan cities that have a population over 200,000, that are already considered transit-oriented. (Levinson, H., Zimmerman, S. and S. Danaher, 2004).

Adjusting land use policies to allow for growth that is concentrated around transit nodes and corridors will help to preserve and enlarge transit's base of riders. At the municipal scale, policies that eradicate barriers to in-fill development and concentrated growth in central areas facilitated by transit can raise transit use (Levinson, H., Zimmerman, S. and S. Danaher, 2004).

When significant investments such as rail lines or bus ways are planned, cautious consideration to station-area land uses can have long-term benefits. At a greater scale, TOD consists of land uses that are pedestrian-friendly. Many times there is an inclination to place rail or bus way stops in areas that comprise limited profitable or

commercial activity (Newman and Kenworth, 2003). Former rail rights-of-way are frequently located in industrial areas (since most industries want to have railroad access). However, it is much easier to increase development where there is already a solid base. Therefore, selecting an appropriate stop location becomes extremely important (Levinson, H., Zimmerman, S. and S. Danaher, 2004).

TODs typically consisted of mixed-use residential or commercial area designed to maximize access to public transport, and often incorporates innovative features to encourage transit ridership (National BRT Institute, 2010). A TOD neighborhood will usually provide some type of transportation hub, metro stop, or in this particular study, a BRT stop. These transportation hubs are surrounded by relatively high-density development with progressively lower-density development spreading outwards from the center (Levinson, H., Zimmerman, S. and S. Danaher, 2004). BRT uses high density development to sustain itself, because without concentrated density, BRT cannot truly flourish (Levinson, H., Zimmerman, S. and S. Danaher, 2004).

TODs are most commonly located within a radius of one-quarter to one-half mile (400 to 800 m) from a transit stop, as this is considered to be an appropriate scale for pedestrian traffic (Dittmar & Ohland, 2004) Architect and urbanist, Peter Calthorpe, brought together the notion of the pedestrian pocket with the idea of planning development around transit stations and is largely credited with sparking this interest in this type of development (Dittmar & Ohland, 2004). In both his design practices and his writings, Calthorpe advanced the concept of mixed-used development and density around transit. He effectively articulated the urban design principles associated with TOD (Figure 2-2).

If a TOD has an appropriate mix of land use, it provides an opportunity to reduce travel by internalizing trips. Internal trip capture is the ability of a mix of land uses to retain trips internal to the development in contrast to the external travel that occurs between a single type of land use (Dittmar & Ohland, 2004, pg 42). A large number of studies have been conducted on the effects of mixed use on travel demands. This research consistently finds that a mix of land uses, combined with additional external factors, such as pedestrian-friendly form and design, can significantly reduce the length of local network trips, mainly for midday and afternoon trips (Dittmar & Ohland, 2004, pg 43).

Typically, when a place of employment is in a single-use environment, even one that is well served by transit, an automobile may be needed in order to conduct everyday business. But if there are appropriate retail services within walking distance, the working population is encouraged to use transit. Employer-based transportation services, such as subsidized transit fares, guaranteed ride home programs, and company vehicles can greatly increase transit use (Dittmar & Ohland, 2004) BRT and other forms of transit, such as light rail and street cars can also be used both to facilitate growth and as a means to initiate growth. Employment densities can effectively spawn growth, but only if the appropriate land uses are in place. The uses that best support mass transit systems are found in Figure 2-2.

The Importance of Concentrated Population Densities

There is a general agreement among city planners that transit use increases, and single-occupant driving decreases, as residential density increases (Dittmar & Ohland, 2004). However, research shows that while there is a link between residential density and transit use, it is extremely intricate and complex due to a multitude of demographic

and socioeconomic factors (Dittmar & Ohland, 2004). The necessary level of density needed to create a dramatic shift in transit use is still undetermined. Several transit agencies [1]recommend a minimum of seven dwelling units per acre to support basic bus service. Transit and walking dramatically increase for shopping trips when residential densities reach six to twenty units per acre (Dittmar & Ohland, 2004). These minimums are considerably lower than many TOD densities, which can range from forty to one hundred units per acre (Dittmar & Ohland. 2004).

Aside from BRT, rail transit-focused development and its proximity to transit and density were the two strongest predictors of transit use. Rail station area residents are five times more likely to commute by transit as the average resident in the same city (Dittmar & Ohland. 2004). The necessity for concentrated employment and housing densities cannot be understated when it pertains to mass public transit. Rail systems are no different than BRT in that respect. Transit systems act as a feeder to businesses and vice versa. These two facets of economic development and transit planning are meant to complement one another, and without the existence of both, maximum efficiency is then lost. Population densities often help facilitate optimum use of BRT. However, these population densities do not always have to be located in the city center. They can be located on the periphery with the assistance of intermodalism.

The Role of Intermodalism with BRT

An intermodal system is one in which individual modes are linked, governed, and managed in a manner that creates a seamless and sustainable transportation system (Szyliowicz, 2010). Such a system should be economically efficient, environmentally

[1] The transit agencies for the following municipalities: Houston, Texas, Gainesville, Florida, and Eugene, Oregon (Levinson, H., Zimmerman, S. and S. Danaher, 2003).

sound, safe and secure and ethically based (Szyliowicz, 2010). When planning for BRT, it is essential to account for other modes of transportation as well. BRT strives to facilitate connectivity just not through an integrated public bus system but through other modes such as walking, biking, and driving (personal vehicle) (McBrewster, Miller, & Vandrome, 2010). The presence of intermodalism within a BRT system would do a great deal to establish serious interest on behalf of the commuter. Commuters are looking for systems that are convenient and when connectivity is present between the different modes of transit, this can be accomplished (McBrewster, Miller, & Vandrome, 2010). While, intermodalism is only one facet of BRT, it remains a focal point for implementation.

The FTA's Bus Rapid Transit Demonstration Program

The FTA's BRT Demonstration Program aids municipalities in determining pre-implementation evaluation criterion for BRT. The programs principal goal is to acclimatize the standards of highly successful BRT systems, to U.S. conditions, laws, and institutions (FTA-BRT Demonstration Program, 2010). A derivative goal would be to develop a unique approach in with working with existing automobile traffic both in the BRT corridors and cross streets, on street parking, turn conflicts, traffic signal preference for busses, more efficient fare collection and boarding, vehicle control, information, marketing, and land use and development, to serve as a model for American transit operators, traffic engineers, and city officials considering BRT for their cities (FTA-BRT Demonstration Program, 2010). This criterion is used to support demonstrations of successful BRT projects around the world. It aims to adapt these same principles of successful BRT to those municipalities in the U.S. who seek to implement the system.

The FTA views ridership levels as being a key indicator in determining the necessity of BRT within a municipality. A municipality must show evidence of maintaining and/or increasing ridership levels, before consideration of BRT. The goal must be to increase the rider satisfaction levels, which are essential elements of BRT (FTA-BRT Demonstration Program, 2010). BRT can have negative or positive impacts on citizens who choose not to use the system. BRT must be planned in a way that allows for traffic signals, or integration could add to travel times for additional users of the system. Inadvertently, this can actually cause reduction travel times for non-transit users. For instance, by doing away with on-street parking (even if it's during more congested hours) could enigmatically benefit transit users but improve travel for all street users as well. This alteration should be weighed against the outlay of eradicating on-street parking (FTA-BRT Demonstration Program, 2010).

The arrangement of the urban environment has become extremely important in the citizen's compliance to utilize public transit. An essential element of the BRT evaluation process will observe how well land use policies can be implemented along with modifications in existing transit service. Municipalities must introduce policies that are more pedestrian accommodating and support a variety of land uses closest to transit. Cities would allow additional growth near high-occupancy transit stops. Policy implementation concerning land use could possibly have subsidiary benefits (this would allow for additional high-occupancy residences or the improvement to the overall walking experience). Nevertheless, the principal transit advantage is their effect on existing and potential levels of transit ridership (FTA-BRT Demonstration Program, 2010).

One of the main objectives of BRT is to advance the overall representation of public transit. Busses are frequently seen as a slow-moving form of transportation compared to the personal vehicle. BRT strives to alter the overall perception of public busses, to one of a well-organized system that can compete with personal vehicles in an urban setting. Every BRT component plays an instrumental role in improving the image of transit as a whole; nonetheless, the marketing and advertising for BRT are devised deliberately for this reason. The name of the BRT service, the emblem, the color scheme and design of busses, bus stops, and signage, web sites, printed materials, and the advertisements all play an essential responsibility in the representation of BRT as an aesthetically pleasing alternative to the personal vehicle (FTA-BRT Demonstration Program, 2010).

With all that said, an enhanced image will ultimately be measured by increased ridership, but surveys from the citizens can also point toward the accomplishment of advertising and promotional efforts (FTA-BRT Demonstration Program, 2010). Decrease in commute time permits transit agencies to supply equal total of service with fewer operator and vehicle hours. This will in turn progress transit effectiveness and productivity. However, these savings will only be recognized when the modifications in commute time are vast, because supplementary limitations on the operation of resources may thwart a decrease in fleet size or work force.

However, it still could be feasible to redistribute resources, i.e., utilizing faster speeds to offer supplementary service (FTA-BRT Demonstration Program, 2010). The FTA-BRT Demonstration Program has been used as a tool for determining implementation indicators for BRT transit projects. However, the system does not take

into consideration important factors such as road structure, population growth, and concentrated density areas. This criterion was used as a guide for application on prospective BRT municipalities. For instance, these guidelines were used for the implementation of Eugene's EmX system (FTA-BRT Demonstration Program, 2010). The primary purpose of utilizing an FTA-BRT criterion is to determine if local municipalities have these necessary characteristics set by the FTA.

Federal Funding Sources for BRT

The most frequently used funding source for major new "fixed guide way" transit projects is the Federal Transit Administration's (FTA) New Starts program. This funding source is the key element that comprised the FTA's Section 5309 Capital Investment Program, which also funds bus facilities and rail system adaptations. BRT is not the only transit technology that can receive New Starts money. Streetcar, rail systems, people movers and automated guide way projects can all compete for these New Starts grants (BRT Policy Center, 2010). Ultimately, a project must be deemed eligible to receive this funding. In order to meet the requirements the plan must involve a "fixed guide way system", that FTA defines as one that "utilizes and occupies a separate right-of-way, or rail line, for the exclusive use of mass transportation and other high occupancy vehicles, or uses a fixed system and a right-of-way usable by other forms of transportation" (FTA, 2005).

Since 1997, the New Starts program has allocated well over $10 billion for new transit development with the majority of these projects being rail related (BRT Policy Center, 2010). This is primarily due to the fact that BRT is still a relatively new concept to U.S cities. Until recently, very few municipalities even considered BRT construction. While the demand for New Starts funding has significantly exceeded obtainable funds, a

great deal of the annual appropriation is already committed to existing grantees, which is making funding for new BRT projects very difficult (BRT Policy Center, 2010). Yet another issue has been the “fixed guide way” requirement, which can exclude high-performing BRT projects that operate on arterial roadways instead of a separate right-of-way.

Even with all bureaucratic fallacies involved in the funding process, the number of BRT projects receiving New Starts money is starting to see significant growth. For example, since early 2001, there have been six BRT projects constructed with the help of New Starts funding, and three more are close to obtaining New Starts money (BRT Policy Center, 2010). An additional four projects are in line to secure, the most often used, Small Starts funding. This is a significant development because before 2001, there were just four BRT systems or bus way projects that were built using the New Starts program. There are more projects scheduled for start up in the near future. Light rail, commuter rail and heavy rail projects have all been built with the aid and support of the New Starts, Small Starts, or Very Small Starts programs (BRT Policy Center, 2010).

U.S. Governmental Accountability Office (GAO) yearly analysis presents some telling statistics that indicate where municipalities are headed, in terms of transportation planning. The 2008 report stated that nearly one-third of the 19 projects in the New Starts pipeline for 2008 fiscal year were BRT systems or some form of rapid bus transport. Until about five years ago, municipalities could apply for up to 80% of the project construction costs. Due to elevated demand for New Starts funding, the FTA typically funds projects that can provide more than the minimum 20% allotment of federal capital (BRT Policy Center, 2010).

Like all federal grant programs, project applicants, generally local governments are required to complete an arduous submission process. New Starts has an extensive and meticulous funding procedure. Ultimately, to obtain funding from the federal government, the project must be recommended in the FTA's yearly New Starts report to Congress. Congress selects the New Starts, Small Starts, and Very Small Starts projects during its annual appropriations process. Projects are lobbied on behalf by key stakeholders to the FTA. Once the FTA approves funding for a municipal transit agency, Congress approves the FTA's request and funding is then disbursed. The Federal Transit Agency evaluates projects on the basis of several criteria, such as: cost effectiveness, potential to improve mobility, and its ability to offer land use planning that supports transit (BRT Policy Center, 2010).

The purpose of the Small Starts plan is to create a more efficient way to receive funding for low-cost BRT, rapid bus or streetcar projects. The Small Starts category was originally created from the more expansive New Starts program in the 2005 federal transportation bill, the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU). Unlike New Starts, these smaller scale projects don't need to function solely on a divided right-of-way to qualify for Small Starts funding.

The Small Starts funding first became available in fiscal year (FY) 2008. Despite the fact that uncertainties persist regarding program policies and procedures, ten BRT projects applied for the funds. The FTA recommended that four BRT projects be given a total of $52 million in 2008. The rest of the FTA's $100 million budget would be set aside for other projects expected to exhibit eligibility for 2009.

Funding for BRT can be allocated in many different forms. Although the subsidy may come from various and numerous sources, a municipality can only use a handful of legitimately feasible resources. Municipalities may use tax programs, state and local funding or in some instances, grant programs to help pay for transportation projects. With that known, the federal government funds a majority of the capital needed to fund such a project. This is performed by issuing a federal grant to help re-development in a certain area.

The GAO interviewed several national transit agencies across the globe that have experience using BRT, LRT, or both, within their respective cities in order to develop a set of standards for funding approval. After conducting all necessary interviews and extensive research, a report was published by the GAO on the topic of BRT implementation. This report concluded that due to the fact that funding for mass transit systems are scarce, local municipalities will have to provide more than the 20 % maximum allotment for construction costs.

Funding BRT is often seen as a hurdle for many cities, but now more than ever cities are looking for governmental assistance to fund such projects. As these municipalities look to the future, it is clear that alternative and cost effective methods of transporting its citizens are crucial. However, to accomplish this goal, the government, Local, State and Federal, must be able to defray the cost. The FTA's discretionary New Starts program is the federal government's main financial resource for supporting locally-planned, implemented, and operated transit "guide way" capital investments. From heavy to light rail, commuter rail to BRT systems, the FTA's New Starts program

has helped to establish hundreds of new or extended transit fixed guide-way systems across the country.

In the process of searching for a last resort effort for funding, there is a supplementary source of funding for BRT, and that is the Very Small Starts program. Within Section 5309 Capital Investment Grant legislation, it mentions Very Small Starts as a “simple, low-risk project that qualifies for a highly simplified project evaluation and rating process by the FTA.” In this case, much like the Small Starts, projects are phased into the current transportation network using an incremental approach. By using an incremental approach, a municipality does not have to invest as much construction time and funding as it would for a larger New Starts project.

The News Starts, Small Starts, and Very Smarts programs have become essential elements in funding BRT projects, irrespective of whether the project is it large or small scale (Figures 2-3,2-4,2-5). It is part of a well thought out arrangement between public and private stakeholders. The key for those municipalities and agencies is to have a financial plan drawn up for the implementation and sustainability of BRT. Through this process all involved parties can determine funding sources allocated and agree on the longevity of these sources (GAO, 2008). Rail and bus investments, in turn, have improved the mobility issues in most cases, as well as helped to reduce congestion and even improve air quality in the areas they serve. Besides helping to better the transportation network, this grant program has also been responsible for cultivating the development of practical, safer, and more livable communities (GAO, 2008).

Since the Obama administration took office in early 2009, there has been an abrupt shift from the existing policy concerning federally-aided transportation projects. There are now specific funding guidelines all transit projects must adhere to before construction can take place (FTA, 2005). Prospective transit projects will now need to be based upon livability issues, such as economic development opportunities and environmental benefits, in addition to cost and time saved, which are already used as the primary criteria (FTA, 2005). As part of this initiative, the FTA will immediately rescind budget restrictions issued by the previous presidential administration in March of 2005 that focused primarily on how much a project shortened commute times in comparison to its cost.

Essentially, the new policy for selecting major transit projects will work to embrace and promote the idea of livability rather than hinder it. The FTA will aim to base their funding decisions on how much transit helps the environment, how much it improves development opportunities and how it improves the quality of life for the everyday commuter. The change will certainly impact how the FTA evaluates major transit projects going forward (FTA, 2010).

In order to make accurate funding decisions, the FTA will now evaluate the environmental, community and economic development benefits provided by transit projects, as well as the congestion relief benefits from such projects. This new method will facilitate the FTA to align priorities and values with prospective transit investments. This recent change in policy is a referendum on developers and project managers alike. Essentially, the FTA will not only help fund innovative transit projects, but they will do so in a way that is “environmentally beneficial to us all” (FTA, 2010).

Beginning in 2010, the FTA initiated a separate rulemaking process, inviting public comment on ways to appropriately measure all the benefits that result from such investments. This could be seen as a positive circumstance because it seems now that BRT projects are ready to compete for funding (FTA, 2010). The FTA will also look to fund projects that will be cost effective for state and local economies and help with smart growth development. Smart growth development aims to achieve a unique sense of community and place; expand the range of transportation, employment, and housing choices; equitably distribute the costs and benefits of development; preserve and enhance natural and cultural resources; and promote public health (FTA, 2010). BRT is just one of many tools that public officials are planning to use to facilitate this growth

The American Public Transportation Association (APTA) cited that 72% of transit tax issues passed in the election of November 4, 2008. As a result, many new transportation projects are being provided by the FTA Federal Transit Administration (FTA) (FTA, 2010). This agency has been inundated with applications for projects seeking grant funding, causing the New Starts and Small Smarts program to become extremely competitive. The current economic environment is compelling large numbers of municipalities to search for innovative, cost-effective alternatives of improved public transit services.

Dissimilar to the New Starts program, transportation projects do not have to function exclusively on a “separate right-of-way” to be eligible for Small Starts funding. Small Smarts projects must operate primarily on a “fixed guide way” or corridor-based bus projects to secure Sect. 5309 funding (BRT Policy Center, 2010). Typically federal New Starts covers up to 80% of project funding, and the remaining 20% is provided by

the local government. However, since there is such high demand for funding among cities around the U.S., the FTA is asking cities to cover as much of the project as possible (BRT Policy Center, 2010).

The advantageous aspect to a Small Starts project is that is uses a shorter, simpler evaluation and authorization process. Projects using Small Starts and Very Small Starts are generally implemented incrementally. If there is a drawback to the program, it would be that it lacks the necessary funding needed. For instance, a Small Smarts project costing roughly $250 million would only be approved up to $75 million dollars, so larger BRT projects cannot meet the criteria. Moreover, the Small Starts budget is limited: Congress authorized $600 million for Small Starts through FY'09 versus $6 billion for New Starts. As helpful as the program is, New Starts has recently been proposed for budget cuts. For fiscal year 2008, FTA requested only $100 million, instead of the $200 million recommended in the authorizing legislation (BRT Policy Center, 2010).

Not every city is suitable for BRT. A prospective user of BRT not only will have to prepare for construction of the system, but the long and short-term maintenance involved as well. Like all capital improvement projects, they involved a substantial amount of capital. Cities must not ignore existing economic conditions. The New Starts, Small Starts, and Very Small Starts programs do enact cancellation of BRT projects that do not meet certain standards for funding. There are certain types of BRT projects that are deemed ineligible for program funding due to the condition that a particular city's local and state economies are in.

Principally, all three of these federal grant programs will not disburse funding for a project that cannot sustain itself. The FTA provides limited funding for operations and they primarily fund capital expenses. However, there is great competition for these funds and local municipalities, and that is why local officials tend to aggressively lobby for their prospective BRT project. One way in which BRT systems can lobby for support, is through an informative efficient advertising campaign.

Other Sources of BRT Funding

Federal Grant programs are not the only way to fund BRT, after all some BRT systems in the U.S. have been around before the New Starts, Small Starts, and Very Small Starts program were even a thought. Private investors and banks have been known to allocate funding towards transportation-related capital investment programs. In the past, local municipalities have been able to put forth a large portion of project funding. However, considering the shrinking funds from all levels of government (local, state, and federal), project money is most assuredly hard to find. Many municipalities will have tax programs set up to help with funding, but this generally does not cover a majority of funding. Rather, this strategy is typically used to pay for any lingering costs that may not be covered by a larger source.

BRT Marketing Campaigns: Strategies for Success

Any time a municipality plan offers a new form of transportation to its citizens, there is going to be some hesitance by its potential users. This is why it is essential to gain the trust and support of the people; who will use the system their confidence in the project will be a large part of what pushes it forward. In the case of BRT, there have been instances of resistance, especially in cities not familiar with the use and benefits of mass transit systems. Too many U.S. commuters perceive BRT as the less appealing

option to that of light rail or subway, and that is only because of the lack of understanding for what BRT truly is (BRT Policy Center, 2010).

Throughout time, we have come to acknowledge the fact that people are resistant to what they do not understand, and this theory resonates strongly with the use of BRT however, this is not the case for several cities in other parts of the world. Those who use the BRT in Curitiba, Brazil, for instance, come from all socio-economic backgrounds; rich and poor, professionals and retirees, young and old, all know the value of this system. Conveying the message of efficiency without distinguishing from social class was essential in changing the mindset of commuters.

According to a Transportation Research Board (TRB) report published in 2004, there should be substantive grass roots efforts leading up to implementation (Levinson, H., Zimmerman, S. and S. Danaher, 2004). In doing so, the transit agency can convey the positives of the system to the people before a resistance can develop. The report lists several successful tactics of BRT marketing strategies. At the inception of the project, Town Hall meetings should be held to provide information in a non-confrontational way when initially approaching the citizens. Typically, the city will invite all relevant parties to the discussion, stressing repeatedly that it is a “discussion” only (Levinson, H., Zimmerman, S. and S. Danaher, 2004). Constituents, public officials, and BRT experts should all be present at this meeting.

There should be maximum transparency when implementing any transit system so that issues can be addressed as they are raised. These sessions should be a “give and take” model with everyone being given the opportunity to be heard. It is also a good idea at this point, to provide some literature for the citizens to take away, this

keeps the project alive and gives them time to think it over until the next phase of planning begins. The TRB report also suggests that someone be appointed as an "information specialist" to field any questions that may arise or suggestions that may come from the people (Levinson, H., Zimmerman, S. and S. Danaher, 2004).

Certainly there are additional strategies of marketing such as television commercials and newspaper ads that can inform the citizens of why BRT should be implemented in their city. When using TV ads, the message must be strong, positive and backed up with testimonials. Specifically, they must convey a pro-BRT agenda, but do so in a short period of time. There must be a list of positives, along with a quick comparison and contrast with other forms of public transit. For instance, many people would not know that a bi-articulated bus can hold nearly the same amount of people as a typical subway train (Levinson, H., Zimmerman, S. and S. Danaher, 2004).
This must be conveyed to the citizens while letting them know that this would not be a crowded alternative to a private passenger vehicle. Newspaper ads should be shown using similar tactics. Again, it must be kept short and to the point (Levinson, H., Zimmerman, S. and S. Danaher, 2004).

With all these factors taken into consideration, there is factor that is essential and that is funding. Without funding, there is no project. The GAO conducted a study on the cost-benefit analysis between BRT and rail transit. This study has been useful in conveying the strong characteristics that BRT provides.

The GAO Report: Conducting Useful Suitability Studies

The Governmental Accountability Office (GAO) supports its claims with extensive research, surveys and numerous interviews with transit agencies. This was an independent study conducted, in a non-biased manner, to understand what the cost-

benefit analysis would be if BRT was implemented in selective cities across the United States (GAO, 2008). The GAO also compares the cost to that of rail transit, this is imperative in understanding why BRT should be the preferred option for transit agencies searching to expand their existing public transportation systems.

This FY 2008 report contains a significant amount of information that is relevant to BRT implementation, specifically; it discusses the need to build within the capacity of the city. For instance, Curitiba is one of the three cases studies that will be used to extract pre-implementation criteria from. However, since the city of Curitiba is one that contains more than a million people, there are certain aspects to that BRT system that would not be relevant in a city such as Gainesville or Ft. Collins. That will be taken into account when applying the PIEC to both municipalities. Fleet size and bi-arterial busses are just two examples of the features that will need to be scaled down in order to properly meet the needs of Gainesville and Ft. Collins residents. If existing conditions are not taken into account prior to implementation, this can possibly lead to a flawed and inefficient transit system.

Chapter Summary

Chapter 2 developed a framework from which to understand the evaluation criteria for federal funding decisions for investments in mass transit project throughout the United States. Over time, BRT has become the choice of more cities because it is the most cost-effective and flexible form of mass transit to date. BRT facilitates economic and transit-oriented development opportunities along the transportation corridor. If a municipality wishes to implement BRT, a federal funding source is recommended, but not essential in implementation. In all cases of documented BRT case studies, the majority of funding has come from federal grant programs. The

program of choice for the United States is the FTA's New Starts, Small Starts and Very Small Starts plan. However, local officials cannot simply ask for this funding to be granted to them without meeting the necessary guidelines. If one is to use the program, the proposed project must fit within eligibility standards. This Chapter 2 establishes the importance in formulating a criterion for BRT pre-implementation conditions. This formulaic criteria inform the methodology use in this research and discussed in Chapter 3.

Table 2-1. BRT Projects Funded by New Starts

BRT Project	New Starts Funding	Total Project Budget
Boston's Silver Line Phase II	$330 Million	$618 Million
Cleveland Silver Line	$82.2 Million	$168 Million
Eugene EmX	$13.3 Million	$37 Million
Houston Regional Bus Plan	$500 Million	N/A
Kansas City MAX	$2.3 Million	$30.7 Million
Orlando LYMMO	$10.5 Million	$21 Million
Pittsburgh West Bus way	$107 Million	$268 Million

Source**:** (BRT Policy Center, 2010)

Table 2-2. Locations that facilitate mass transit

- Banking services
- Convenience retail such as drug stores and food marts
- A wide variety of eating establishments
- Child care
- Recreational opportunities (parks, plazas)
- Business retail (office supply, copy and print shops, overnight delivery)
- Personal retail (dry cleaners, hair styling, bookstores, and health clubs)

(Source: Dittmar & Ohland, 2003)

Figure 2-1. Mass transit incorporating intermodalism (Source: Dittmar & Ohland, 2003)

Very Small Starts	- Transit Stations - Signal Priority/Pre-emption (for Bus/LRT)[2] - Low Floor / Level Boarding Vehicles - Special Branding of Service - Frequent Service – 10 min peak/15 min off peak - Service offered at least 14 hours per day - Existing corridor ridership exceeding 3,000/day - Less than $50 million total cost - Less than $3 million per mile

Figure 2-2. Very Small Starts Criterion (Source: FTA, 2010).

Small Starts	Funding request must be less than $75 million.	The project must be a “fixed guide way” for at least 50% of its peak period	The project must be a corridor- based bus project	Signal priority/pre-emption, level or low floor boarding busses, branding and frequent service.

Figure 2-3. Small Starts Criterion (Source: FTA, 2010).

New Starts	Funding request exceeds more then $75 million.	A fixed “guide way system”, which FTA defines as one which "utilizes and occupies a separate right-of-way, or rail line	For the exclusive use of mass transportation and other high occupancy vehicles	Uses a fixed cantenary system and a right-of-way usable by other forms of transportation

Figure 2-4. New Starts Criterion (Source: FTA, 2010).

[2] Signal priority is used by public transit systems (i.e. light rail, bus rapid transit) to bypass traffic signals in order reach destinations without any hindrance of traffic (Levinson, H., Zimmerman, S. and S. Danaher, 2004).

CHAPTER 3
METHODOLOGY

While the FTA has specific criteria to decide among the many applications for funding under the Very Small Starts, Small Starts, and New Starts program, that criterion does not take into consideration other factors such as density, existing road infrastructure, and population growth. The same can be said for the FTA-BRT Demonstration program. A systematic list of implementation criteria will begin to develop throughout Chapter 3. The methodology used in this study is largely based upon documented evidence related to successful BRT implementation models. In order to determine the efficiency and long term use of BRT, existing, successful transportation models are examined from countries, states and municipalities that have already implemented BRT. To implement BRT, a specific list of pre-existing criterion must be present. This criterion will prove to be the main determinant used in conducting feasibility studies for BRT.

Research Design

This research design uses a case study methodology to accomplish the major goal of developing a PIEC, which is to understand pre-existing conditions for successful BRT systems. Three case studies of successful BRT implementations—Curitiba, Bogotá, and Eugene— form the basis of the development of models for successful implementation of BRT. These case studies are examined to develop a template of pre-existing conditions and policies that must be in place before a BRT project can begin. Funding sources for each BRT model are carefully analyzed to better understand the necessity for specific types of funding. The purpose of observing these successful BRT cities is to acquire a template that will determine which conditions, roadways, and

policies must be in place before the project can begin. These factors are then analyzed to understand the importance of having the necessary pre-existing conditions suitable for BRT. Detailed planning will be essential to an innovative and municipality-altering transit system, like that of BRT. Every detail, regardless of how insignificant it may initially seem is examined.

Based upon a proper analysis of the characteristics of these three successful systems, a PIEC is developed. The PIEC is then applied to two cities – Gainesville, Florida, and Ft. Collins, Colorado – that are currently proposing BRT systems to determine of these cities are suited for investment in BRT. This study incorporates the use of successful transportation models to conclude which city would be able to sustain BRT, while considering all pre-existing factors.

Data Collection Methodology

The evaluation of successful BRT models in order to understand pre-implementation criteria included multiple sources and qualitative material from documents, site visits and one interview with the chief transit planner for the City of Gainesville. FTA documents relating to capital investment projects were examined to understand the evaluation criteria used to prioritize investment decisions. These criteria were supplemented through the evaluation of successful case studies of BRT implementation. The secondary sources used in the research study included recommendations by the BRT Policy Center, TCRP, GAO, and FTA. Planning documents were also reviewed to understand the details involved in each existing and proposed BRT system.

One interview was conducted with a leading transportation planner for the City of Gainesville. The discussion pertained to the operation of BRT. The interview was semi-

structured in format, allowing the investigator to gather essential knowledge as well as insight derived from additional discussions with the interviewee. The questions related to the highlighted topics mentioned within the literature review. In order to prevent the potential of investigator bias, information included in the analysis was limited to the facts presented to the interviewee. The information obtained from the interviewee that was recognized as bias was fully reviewed and corrected if necessary. The University of Florida's Institutional Review Board approved all questions prior to the interview process. The investigator followed the standard procedure of acquiring informed approval of the interviewees, audio taping the interviews for a necessary record at a later time, and disposing of the transcripts after the completion of analysis.

Significance of Using Successful Case Studies

To truly understand the significance of PIEC, it is best to use practical, real-life examples, and that is what this Chapter 3 conveys. Three case studies were selected because of their successful BRT systems. The methodology carefully analyzes each system, discusses relevant history pertaining to the specific BRT, and then recognizes the significant pre-determinants that each municipality had in place before BRT implementation. Each of the three had its own set of unique conditions prior to implementation, but there were also conditions that all three had in common.

Federal funding for each project played a pivotal role in the feasibility for integration of BRT. After careful analysis of each cities proposal, it became quite apparent that without the allocation of federal funding for each, BRT would have been realized. As essential as it was to receive these funds, the money was not given freely. It had to be justified, earned, and approved. For each system, the project had to meet certain eligibility standards just to be considered for federal funding. All three systems

were able to meet eligibility for federal funding of BRT. The use of Small Starts was vital in the project development for Eugene's EmX system. Bogotá and Curitiba both utilized funding from a private organization (i.e. World Bank) that covered a majority of project costs, with the other expenses being picked up by independent lenders and banks. Government can only pay for a certain portion of the allotted costs. Case studies were used to understand adaptability of PIEC for mass transit, specifically, BRT. By observing real exampled of BRT success, a template can then be formed and a PIEC developed.

As municipalities continue to grow, local governments are compelled to provide transit options. In the coming years there will be a growing need for mass transit usage and BRT will be looked at as viable transit option. In fact, if trending continues as predicted BRT will become the norm rather than the exception, particularly if gas prices continue to spiral out of control. Local officials must spend wisely because most cities within the U.S. can ill afford to make such a devastating policy mistake, which is the primary reason for the formulation of a set criterion for BRT.

Federally funded transportation projects play an instrumental role in the transformation of transportation in America. However, the funding for these projects is likely to become more and more difficult to obtain. Local and State municipalities will be asked to cover more of the project costs, yet the budget is shrinking in all levels of government to accomplish this. Those municipalities who offer more than the required 20% project costs will be given priority over those who do not. An efficient and effective PIEC is needed to ensure that feasible conditions are in place before implementation takes place. This is why case studies must be observed and examined.

Curitiba BRT: Pre-Implementation Conditions

Prior to implementation, there were many determinants present that led to the inception of BRT in Curitiba. It is well documented that Curitiba was the most exemplary city for this type of mass transit system. Fortunately for Curitiba, the risk was minimized because there were so many factors pointing towards new a form of innovative rapid mass transit. Curitiba chose BRT over light rail because although it already had a bus system in place, it was insufficient to meet the population's travel needs. There were too few busses, not enough bus routes, and wait time was unsatisfactory. Curitiba was looking for a transportation system that would not leave the city in complete disarray due to ongoing construction. The city was looking to construct a system that could adapt and do so in a cost effective manner.

In tandem with the Master Plan, city officials ordained design and construction for two high-capacity roads out of the intended five which would sooner or later form intrinsic passageways and determine proliferation sequence in Curitiba. The complex passageways comprised of dichotomous road systems while the main road consisted of two enclosed lanes launched for the purpose of express busses. Bilateral roads that ran antagonistically were formulated parallel to the express bus lane. Due to the formation of these roads, the vernacular traffic had the privilege of passing through Curitiba effortlessly and without hindrance.

Five complex passageways were constructed in 1982 along with inter-city and tributary lines. Similarly, government-regulated laws on how to use these facilities were put into action and helped in revolutionizing Curitiba. Construction of capacious residential and commercial areas was envisioned along the passageways, which would enable cumulative population densities to flourish. However, these authorized

conglomerates disintegrated from cosmopolitan apartments to neighborhood residences (Rabinovitch and Hoehn, 1995). There is no question that BRT is typically more efficient when applied in city with a population of a million plus, but that is not always the rule when constructing mass transit.

For years leading up to the implementation process, there was a heated debate as to what type of rapid transit would be most efficient in terms of economics and utilization of current infrastructure. The cost of an innovative subway system was projected at over $90 million per kilometer, versus just $200,000 per kilometer for construction of new BRT routes. This was crucial because 80% of Curitiba's first transportation corridor would be funded by government funds. Since the time of BRT inception, the city reports several positive results. Travel time throughout the city has dropped dramatically, overall detrimental emissions have dropped, and total street congestion has decreased significantly (Rabinovitch and Hoehn, 1995).

Currently, 75% of Curitiba's population utilizes public bus transportation on BRT in Curitiba has truly demonstrated sophistication and innovation in its practice. Traffic lights are delayed for approaching busses, which lessens the amount of time in between stops for the riders. A computer chip mechanism located inside the bus triggers sensors on the road, which then alert the passengers at the next station if the bus is running on time. Lastly, the central explanation for Curitiba's BRT success is the fact that the municipality has implemented designated bus lanes. The idea may lack the technological advancement of a "state of the art" microchip, but it is arguably the best feature of the system.

This technology allows busses to run without stopping for oncoming traffic, without the delays of stoplights and without having to wait for rush hour traffic to clear so that they can pull back out into the flow after picking up riders. Living in a town with an active bus line, one knows the countless times that traffic comes to a complete standstill while riders disembark and reload and the additional time involved for those needing wheelchair access or who have small children or, worst case scenario, a bicycle that they need to retrieve from the front of the bus. By utilizing the concept of dedicated bus lanes, the BRT system is able to eliminate many of these issues while also keeping traffic moving in an orderly pace.

Intermodalism is a concept that Curitiba and its RIT system are still attempting to master. They have been able to reach the large working population densities on the periphery by the use of feeder busses [3] Where Curitiba has failed, is in its incorporation of bicycles with the BRT network. Most BRT systems in Curitiba do not have adjacent bicycle routes located along the personal vehicle lanes. Acknowledging this failure, city plans will now look to add bike routes wherever there is a new BRT system being constructed. Curitiba was able to secure some project funding through state grant programs, but the largest contribution came from the World Bank, who put forth over 80% of the construction costs.

Curitiba has done a more then adequate job of persuading its citizens to understand and embrace the idea that a public transit system is not a mode of transportation that is solely used by lower-income residents. People of all from all walks of life, ages, and income levels come together to use this form of rapid transportation.

[3] Feeder busses are busses that roam through neighborhoods that are generally located far from the city center and take them to more heavily used bus station closer to downtown.

This was accomplished by years of strategic planning and preparation. Many workshops and presentations were given to the people of Curitiba so that they would understand the benefits of the system. This, along with a compelling ad campaign most certainly eased people's doubts and fears of the system.

In Curitiba, public bus transportation is thought of more as a common necessity than a negative riding experience. Rather than resist the implementation of the BRT system in Curitiba, the people have embraced this form of public transportation and now the network maintains a circulating fleet of 1,860 busses (not including the reserve busses, which account for nearly 300 additional busses). Public transportation in Curitiba is used quite often. Nearly 70% of Curitiba's population uses BRT in order to commute to and from work, and this number has remained high for quite some time (Rabinovitch and Hoehn, 1995). BRT is thriving in Curitiba and this is only because intricate strategic planning that took place long before BRT was implemented.

Bogotá BRT: Pre-Implementation Conditions

The TransMileneo BRT was implemented in 2001 and proved to be an immediate success by meeting the stated goal of improving system performance and increasing ridership. In the early months of its operation, the number of vehicles had to be streamlined to 18,000 to meet transportation needs, while the speed of the busses tripled from 5 mph to roughly 17 mph. (Baltes, Cain & Darido, 2008). The average commuting time was reduced by 60% from the original 90 minutes to 35 minutes (Baltes, Cain & Darido, 2008). TransMileneo daily transported 900,000 passengers, much higher compared to various metro lines because of an increase in ridership from just 45% to an amazing 95% of all commuters (Baltes, Cain & Darido, 2008). Alongside

these improvements, frequency of service was increased up to three busses a minute in each direction during the most congested traffic durations.

The TransMileneo BRT now covers approximately 52 miles, has 114 stations throughout the area, and runs 857 articulated busses to provide service to citizens (Cannell, 2008). The daily ridership numbers have also surpassed original estimates. Today, in excess of 1.3 million people are daily riders. With 57 routes and 430 new conventional busses functioning, the feeder network stretches to 296 miles (Cannell, 2008). For the most part, the implementation of TransMileneo has renovated the network of previously entangled routes with unappealing busses into an integrated system that provides a pleasant, prompt, expedient, and competent service (Baltes, Cain & Darido. 2008). Strategic marketing, spearheaded by Enrique Peñalosa, was instrumental in gaining the peoples' trust throughout the process. Workshops were held and television advertisements were broadcasted, showing the benefits of BRT in Bogotá.

It is undeniable that TransMileneo's BRT has been able to improve the quality of life in the city. By reducing traffic congestion and everyday road traffic, the system has contributed in a profound way to reducing atmospheric pollution, reduced by 40%. The system has reduced traffic congestion and the number of on road vehicles as evident from statistics of a metropolis situated at 2,600 meters altitude and where the effect of greenhouse gases is very visible (Cannell, 2008). There have been other notable consequences in the context of urban safety. Statistics show a reduction of 81% in automobile accidents and a reduction of 94% of accidents where vehicles and pedestrians are both involved. Number of injuries fell by 72% while the fatalities

decreased by 93%. The number of robberies has also decreased by nearly 60% (Baltes, Cain & Darido. 2008).

In parallel with the central part of the BRT program, some other remarkable enhancements have been revealed including the construction of almost 155 miles of bicycle lanes, redecoration of 160 acres of walkways and civic areas, tree planting, limiting the use of private automobiles at rush hour, and the development of several park-like areas and pedestrian plazas throughout the city (Cannell, 2008). Intermodalism was a point of emphasis for the TransMileneo system in Bogotá.

These fringe benefits of the TransMileneo project have also affected the urban environment in a positive manner (Baltes, Cain & Darido. 2008). Bogotá has done a remarkable job in incorporating the use of bicycle transportation with that of busses and personal vehicles. In many of the TransMileneo bus station their bike renting and storage for those who choose to bike from home to the bus station, then use BRT to commute throughout the city.

Finally, TransMileneo has linked neighborhoods and opened up the urban job market at a reasonable fare and therefore played a pivotal role in reducing the segregation in the society. In many ways, this project can be considered the largest social project ever accomplished in Bogotá. The daily roundtrip journey costs only $0.40 per trip, meaning that transportation costs are just $16 a month, which is only 6% of the average household budget (Baltes, Cain & Darido. 2008). By contrast, the inconvenience and cost of operating a private vehicle, especially with the volatile gas prices, makes TransMileneo the best value without question.

The pricing policy has been developed while keeping in mind the varied segments within the existing and possible consumer base. The constructive impact of such a policy is that it includes all segments of the population. In terms of employment, the TransMileneo system offers higher salaries. The controlling company, Ciudad Movil, offers its bus drivers an average salary $480 per month (Cannell, 2008). This is above the local average income, making it one of Bogotá's top employers (Baltes, Cain & Darido. 2008).

There are impressive plans for the coming years for TransMileneo, including four extensions by 2016 to construct a state-of-the-art rapid transit system of busses which will be 236 miles long and will be an international standard for sustainable urban development (Cannell, 2008). At the end of the fourth stage, TransMileneo will be able to accommodate 6.3 million passengers per day and serve as a reminder that it is practical to build a high capacity transit system offering high service quality within a reasonable investment.

TransMileneo is expected to evolve from being just a bus transit system into a more intermodal system. The currently deployed road and rail network can be easily converted any time to into a surface rail-based transit system if there is a need. One thing is for certain, TransMileneo has turned out to be a guideline for excellence and various key cities are beginning to show interest, particularly in the United States and Asia, where so many cities are in need of an effective BRT system. It is the hope of the government of Bogotá that TransMileneo will dominate the roadways and displace the automobile. Every city who invests in public transit ultimately wants to become more pedestrian oriented, which means less dependency on the personal vehicle.

Eugene BRT: Pre-Implementation Conditions

After observing this system and from documents and conversations through emails with city planners and engineers, it became apparent that Eugene, Oregon was a perfect fit for BRT. When Eugene brought in the EmX system they had something of a "perfect storm" for pre-implementation conditions. (Figure 3-1) Funding for the first EmX line was paid for by the Small Starts FTA Program. The initial cost of the project was $24 million. FTA covered close to 80% of the project costs, delivering $19.2 million to the City of Eugene and its current transportation network.

Without the use of Section 5307 and 5309 funds, this project would have been nearly impossible to construct. The remaining costs were covered by budget cuts to unnecessary local expenditures. Concentrated housing and employment densities were already present in Eugene, with the University of Oregon supplying the majority of jobs. Housing densities are in the form of mass numbers of students and University employees who, for the most part, lived in close proximity to the proposed BRT corridor. These two population densities helped to provide a purpose for construction of BRT. In order to receive funding from the Small Smarts Program, a "dedicated guide way" needed to be mentioned within the planning-design phase. This was vital in order to ensure that this Green Line corridor would be constructed. With this Green Line project, a door has been opened for a more intermodalistic transportation network to occur.

Intermodalism has long been found throughout the urban transportation network of Eugene, but this would mark the first time that all comprehensive planning will consider the factor of intermodalism. Bicycle routes and raised curbs already exist on the Green Line helping to create a designated lane separating cars, bikes and busses.

The Lane Transit District felt that this was critical to advancing commuter travel times and maintaining service dependability.

Nonetheless, the organization dealt with numerous problems in providing rights-of-way along this route. The Lane Transit District was ordered to reduce disruption to personal vehicle traffic along the corridor, restricting their ability to eliminate parking or travel lanes. Since population growth within the metropolitan area of Eugene has been at a steady rate of 3-5% annually, this facilitated a more detailed discussion into the implementation of small-scale mass transit system.

The City of Eugene sought to update its existing bus system with a more advanced, efficient, and reliable form of mass bus transit. The city essentially needed only to separate lanes by medians and decrease the number of lanes from four to two. While it sounds odd that a city would want to reduce the number of traffic lanes available, it must be remembered that BRT would move the citizens in a more expeditious manner, thus eliminating the need for private modes of transportation. Even with the reduction in the number of lanes, traffic flow would be much improved

The marketing campaign was a strategic and vital measure carried out by local officials to ensure that the public understood the many ramifications of BRT in Eugene. A year before implementation, town hall meetings were held on a weekly basis to hear and discuss the concerns of the citizens. These meetings were comprehensive, in-depth, and ran the gamut of topics until all involved were comfortable with the proposal. These meetings were ongoing even after construction began and helped to allay the fears of the citizens who worried that this new system would disrupt their way of life.

Along with these workshops, the City of Eugene ran a number of pro-BRT advertisements utilizing all forms of media. The goal of these efforts was to keep the people fully informed, make them feel invested in the project, and give them a voice. City government wanted to avoid any upheaval related to the construction of the EmX system and their approach was to take the offense rather than have to defend the decision after the fact. All of these measures were successful as the citizens began to anxiously await the arrival of this new system and embrace the possibilities.

Synthesization

The allocation of federal funding for BRT projects proved to be a vital piece of the concept. In order to receive available federal funding, a municipality must prove itself eligible for the funds. This is accomplished by means of a rigorous set of criteria which must be met in total. When applying for federal funds there is little to no leeway and no acceptable deviation of the qualifying regulations.

As the findings are determined, a PIEC will be applied to Ft. Collins and Gainesville. By applying the PIEC to the cities of Gainesville and Ft. Collins, an understanding of system feasibility can be recognized. Chapter 4 will also include the three case studies upon which this research is based. It will observe the proposed pre-implementation conditions in a functional format and will lead to a greater understanding of the necessity of these conditions.

These three examples of successful BRT systems were chosen for their efficiency, longevity, and innovation: Curitiba, Brazil, has long been perceived as the pioneering city of mass bus transit. In the city of Bogotá, we find the TransMileneo system that is the successor to Curitiba's BRT. This system is destined to become a mega multi-modal transit system, with its planned incorporation of rail and bicycle

routes. Lastly, there is the most recognized U.S. model for BRT which can be found in the city of Eugene, Oregon. Although not an extensive, widespread system, it still offers many of the same benefits as those of the aforementioned South American models. Though dissimilar in their demographics, population size, and overall scale, the pre-implementation similarities of each city are undeniable. Each one of these municipalities possessed advantageous conditions that were conducive to BRT prior to implementation.

Development of BRT Pre-Implementation Evaluation Criterion (PIEC)

By observing FTA Criteria for BRT and the three successful BRT implementation models, a set list of determinants will be utilized as a compulsory pre-implementation evaluation criterion. The criterion was based primarily upon documented accounts of conditions in each of the three model BRT cities. Recommendations by external sources were taken into consideration to give the study even more relevance. However, in this study, the documented account of pre-existing conditions prior to implementation was the most crucial aspect of this research. This is because without concrete, practical observation of these determinants in municipalities that provide BRT, one cannot acquire a true sense of value for each component.

There are several factors that are considered in developing the PIEC for BRT, but perhaps the key element is funding. By carefully proposing its system in a positive and thoughtful way, federal funding became a very real option as the city of Eugene became eligible for New Starts funding. The design plan entailed implementing a “fixed guide way” and in this case that meant a designated lane just for busses to run on.

Without federal funding this project would not have come to fruition. The New Smarts plan in this case covered in excess of 80% of the projects costs. As mentioned

in the literature review, this is common among projects eligible for New Smarts or Small Starts funding. In each case of mass transit planning, there are many factors that seem to be more relevant or crucial for BRT planning then others. When it came to the proposal in Eugene, there was no more vital aspect to the realization of the concept planning then the allocation of federal funds.

The existence of concentrated housing employment densities is essential to the functionality and longevity of a BRT system. These two densities serve as economic nodes that provide subsistence for a BRT system, and will, in turn, ultimately spur other types of development (i.e., retail, commercial and mixed-use). The importance of these existing population densities serve as an implementation determinant for BRT. Mass transit should be placed in areas where it serves the greatest number of citizens possible. It is these concentrations of homeowners, renters, and workers that will serve as a guiding beacon for BRT development.

Ultimately, the methodology for this study was determined by examining the successful BRT systems in the cities of Curitiba, Bogotá, and Eugene, in coordination with relevant transit-oriented topics. These cities have all proven to be transportation models that prospective BRT cities are encouraged to embrace. From the information gathered through the analysis of each system, a set of criteria was born. There are certain factors or determinants that are more essential for project development then others

Careful examination of population trending will also serve as a key determinant for land use necessity. For example, if population trends identify an increase in population within a certain section of any given municipality, that growth area must be

identified for potential development which meets the particular needs for that identified demographic, along with an accommodating public transit system. Observing population growth or decline becomes a useful indicator in determining if mass transit is, in fact, a practical solution to plan for population growth.

City officials now understand the importance of having a workable alternative to travel by private vehicle. With rising fuel costs, crowded streets, pollution, and working poor who cannot afford an automobile, the need is great and must be addressed. City officials know that in order to facilitate such an alternative transportation model they must first have a readily adaptable mass transit road infrastructure already in place. Simply said, there would be a significant cost-benefit involved in having the right road network in place thus saving the inconvenience and excessive cost involved in the widening of existing roads to accommodate a BRT concept.

Citizens do not favor prolonged construction with such projects. It is wildly unpopular with business owners whose stores may be completely cut off from traffic for extended periods of time, thus impacting their revenue, and for the patrons who cannot access the services in those areas of construction. It is not unusual for this construction to cost up to three times more than a project not requiring the altering of road widths.

Finally, there is an often overlooked principle for good, progressive BRT planning and that is the need for an aggressive, sound, subtly persuasive marketing campaign while the project is in its beginning stages. Citizen buy-in is a must in the creation of a successful system. In the United States there is certain stigma attached to bus lines, and that notion must be completely dispelled if the project goal is to be achieved. U.S. citizens tend to associate riding the bus with being poor, but this is not the case in other

countries. That is not to say that the citizens of Curitiba, Bogotá, and Eugene were 100% accepting of the BRT proposal, many were not.

However, they were not concerned as much about the stigma as they were about the fact that such a system might have a negative impact on their quality of life and the prosperity of the city (Levinson, H., Zimmerman, S. and S. Danaher, 2004).
This is where clever marketing and the inclusion of the people in the developmental stage helped quell their concerns. Local officials in all of the model areas knew that the success of their proposed system would lie, in no small way, with public acceptance (TCRP, 2010). They were adept in the creation of their various media campaigns so that by the time the system was up and running, the populations of these cities were more than ready to commit to BRT.

The methodology in this study is drawn from topics discussed within the case studies of Curitiba, Bogotá, and Eugene. These topics were chosen after meticulous analysis of BRT and its immeasurable intricacies and nuances. Each element to pre-implementation criterion carries its own significance in completing the planning of rapid bus transportation. There is most certainly a symbiotic relationship linking all determinants together. Thus, it is relatively difficult for one element to function without the existence of one or more of the others. It is necessary that accurate and pertinent examples of each determinant be mentioned. Real-life examples will only help to provide a better understanding of this criterion.

An Application of Pre-Implementation Evaluation Criteria (PIEC)

This research study will attempt to apply an established list of determinants for the purpose of identifying the feasibility of BRT application in two experimental case studies. Two municipalities were selected for this application test. These areas were not

randomly selected, rather they were chosen due to their commitment and need to implement some form of BRT. The design phase is underway and the only current deterrent lies in acquiring the necessary funding. Throughout this Chapter 4, all pre-implementation determinants will be identified in each city. First, it is necessary to discuss each city's preliminary planning and profile, so that a better understanding of the current conditions can be recognized. By accomplishing this, the importance of each determinant and its effect on BRT implementation will be realized.

From these three case studies, a PIEC can now be recognized and applied to the case studies of Ft. Collins and Gainesville. A set list of pre-determinants conducive to BRT was extracted from a literature review filled with pertinent topics regarding emblematic mass transit indicators. In Chapter 4, these indicators were viewed in realized case study form. The purpose was to achieve a firsthand account of how each system worked with the indicators and determinants for BRT. Chapter 4 will continue by an application of this newly formed criterion. These newly acknowledged determinants for BRT will be used determine necessity and feasibility in the two experimental case studies: Ft. Collins, Colorado and Gainesville, Florida.

Table 3-1. EmX - BRT Characteristics. Source*:* Data assembled by Lisa Callaghan Jerram from the MTI, 2008.

BRT ELEMENT	EMX GREEN LINE	PLANNED ADDITIONS
Running Way	Dedicated median running way for 60% Curbside bus lanes for 40%	
Stations and Land Use	Enhanced stations with near-level boarding, Two transit centers, with joint development at one.	
Vehicles	High-capacity, low-floor stylized hybrid busses. Multi-door boarding on both sides.	
Service and Operation Plan	10 minute headways. All-stop service only. Longer station spacing than local service.	
Fare Collection	None for 2.5 years.	Off-coach, pre-paid fare collection as of Sept. 09 Station ticket machines
ITS	TSP at all intersections, queue jump	Real-Time Passenger information.
Marketing and Branding	Strong branding and marketing program to identify EmX as premium rapid transit	

Table 3-2. Model PIEC for BRT

Case Study PIEC	Importance	Example
Concentrated Employment Densities	A large number of citizens should be able to use BRT for their daily commute to work. BRT and employment clusters must be linked.	Curitiba – Manufacturing and Industrial Industries on the periphery Bogotá – Downtown businesses and manufacturing industries locate on the periphery Eugene – Hospital and the University of Oregon
Persuasive BRT Marketing Campaign	Public transit users must understand the benefits that BRT has to offer.	Curitiba - Television Advertisements Bogotá - Town Hall Meetings Eugene – City information sessions, workshops
Already Existing Public Bus System	There must be an already effective public bus system, so that a transition in systems engineering is not too drastic.	Curitiba – RIT Bogotá – TransMileneo Eugene - EmX
Adaptable Road Infrastructure	Existing road infrastructure must be flexible for implementation of BRT. *Intermodalism should be incorporated in planning	Suitable street widths were all present with initial BRT corridors for: Curitiba, Bogotá and Eugene.
Must Have Sustainable Funding Source	A majority of all BRT systems worldwide have been funded using federal grants or private lenders.	Curitiba – State Grant Funding, World Bank Bogotá – State Grant Program, World Bank Funding Eugene - New Starts Funding

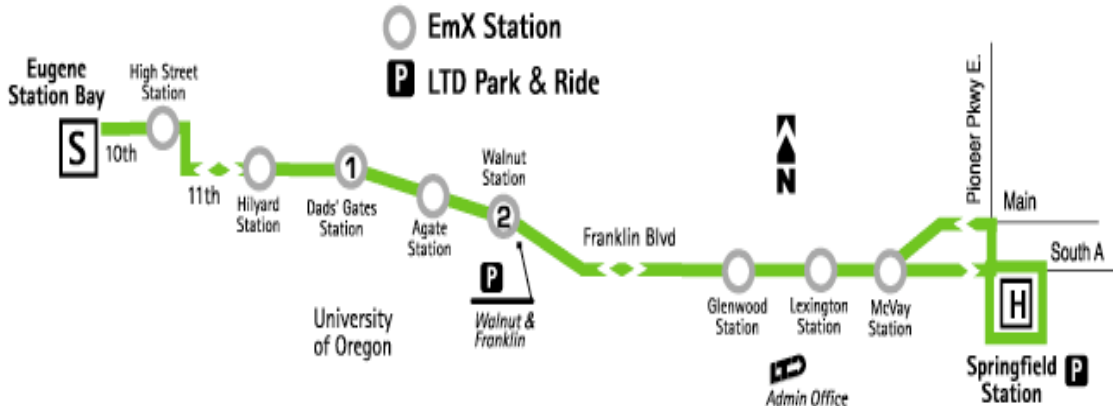

Figure 3-1. EmX Route System (Source: City of Eugene, 2010).

Figure 3-2. Eugene's EmX System (City of Eugene, 2010)

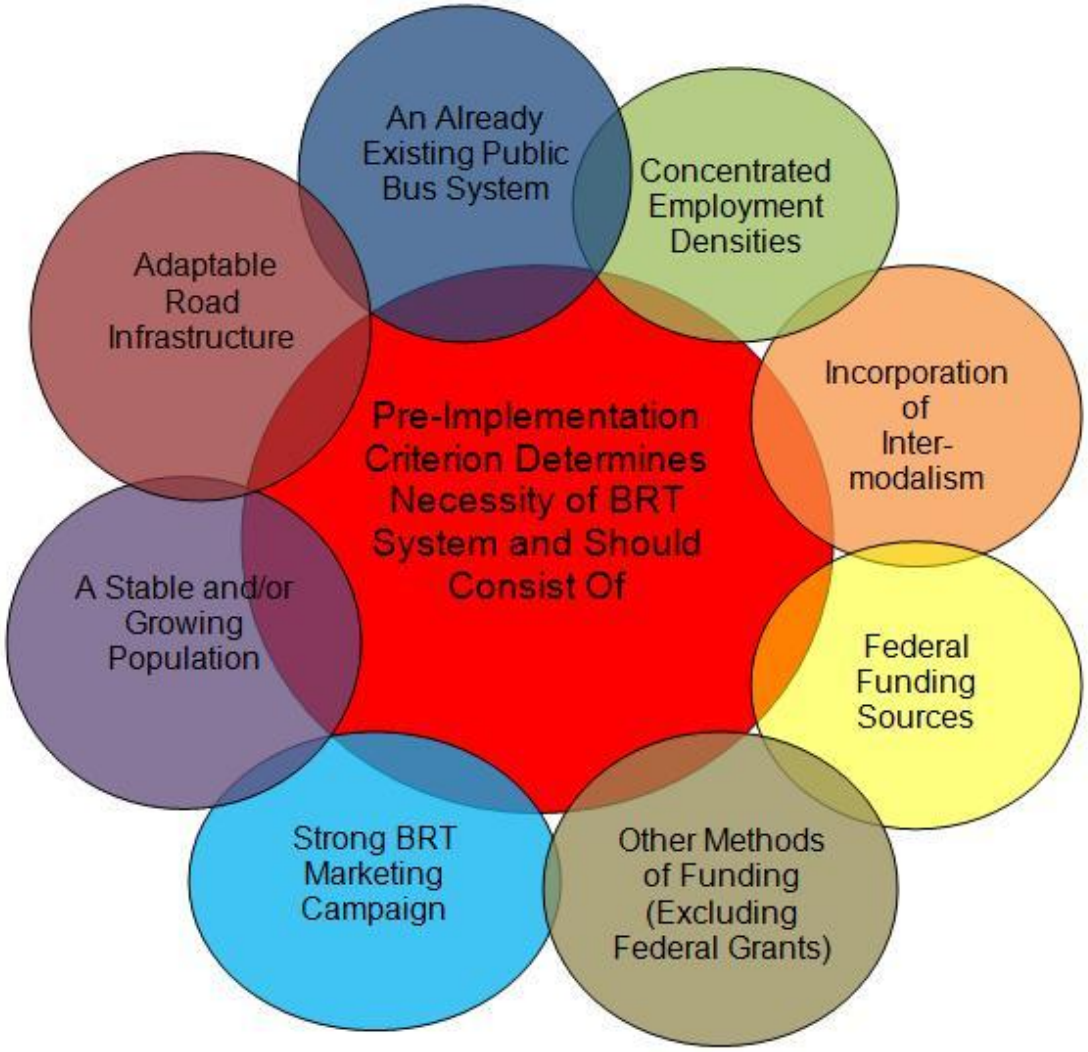

Figure 3-3. Preliminary list of PIEC for BRT

CHAPTER 4
RESULTS AND FINDINGS

Chapter 4 will discuss the BRT plans for Ft. Collins, Colorado and Gainesville, Florida. The now developed PIEC will be applied to both Ft. Collins and Gainesville in order to examine the conditions for each municipality. Chapter 4 will conclude with a comparison of PIEC to both municipalities.

Plans for BRT: Ft. Collins, Colorado

Ft. Collins, Colorado is a college town located in northwestern Colorado. As home to Colorado State University, it is a rapidly growing city. There are currently some 150,000 residents in the city, 5,850 of whom are faculty and staff of the University and another 24,800 of whom are students (City of Ft. Collins, 2010). Ft. Collins has been nationally recognized for its quality of life, a factor that compels many to relocate there each year. From this increasing population however, comes the burden of finding ways to accommodate the citizens and their needs with appropriate development and transit options.

Throughout most of Ft. Collins large and small retail, commercial and residential development is underway to keep up with the increasing demand. With growth comes the reality that the values and simple beauty of this city could be compromised. The city cannot afford to jeopardize the values that draw so many to the area. Prior to undertaking a BRT system, the city official in Ft. Collins made it that they would not allow a transit system to disrupt the charm and lifestyle that had been established. With those concerns in mind, Ft. Collins has begun the implementation process, which they hope will bring them a successful BRT network while preserving the bucolic characteristics of the city.

As previously stated, a combination of a good quality rail merged with flexible and durable tires of the vehicle adds to the enhanced features of MAX. The Ft. Collins system can provide the passengers with a convenient system while ensuring that the comfort of the passenger shall be given the first priority. Large windows with hand rails are installed to assist the standing passengers and those who have boarded their bicycle too. MAX will also be equipped with a precision docking system and level boarding that would help minimize the trouble that one would usually come across due to passengers boarding on strollers and wheelchairs. Along with the busses, transportation hubs will be constructed in high-ridership areas. The architectural design of the bus will ensure to establish transit centers with stations and lots of stops that can fit effectively into the present scenario. In addition, there are numerous chances to proceed with future TOD projects.

With the advancement in modern transportation technology, the schedule for the bus will be displayed in a real time system along with an automatic vending machine to purchase tickets and eliminate the last minute hassle to board the bus. Hence, there would be no fare collection inside the vehicle, which is another factor that slows the flow of the system. MAX will run along some of the more busy arterials in Ft. Collins. Many of these routes will pass along student housing, commercial use, and most notably, Colorado State University itself. In fact, the guide way is an integrated part of the service itself. While there is always the potential in a college town for traffic to become gridlocked, the time that MAX would take to reach the destination will not be dictated by the amount of traffic that occurring on adjacent, personal vehicle lanes. It will have its own dedicated, controlled lanes.

The proposed BRT street network, known more specifically as the Mason corridor, extends five miles from north to south with Cherry Street on the north and Harmony Street on the south lying within the city of fort Collins. MAX, also branded as the Mason Area Express, is a transit system that offers many of the same qualities of a rail system but with more route flexibility. The proposed MAX system is striving to be highly efficient and will travel up to 45 mph with ITS elements allowing for non-stop rides. Once waiting at the bus stop, it can provide departure in less than ten minutes during the rush hours. At the same time, MAX has an incorporated design with two most important factors to ensure – speed and convenience providing an exclusive gateway. The busses will be installed with a real time system displaying the schedule of the arrival and departure of the bus along with the facility to park and ride along the corridor (Figure 4-1).

The descriptive and theoretical assessment of successful BRT models used by Ft. Collins and Gainesville demonstrates how adaptable PIEC are to the success and longevity of a BRT project. Whenever there has been advancement in modern technology, the past must be examined so that it can provide a way to build from a preconceived “primitive” design. The same holds true today and it is this thinking that will advance the planning and design of mass transit systems, in this case, BRT.

Applying Pre-Implementation Evaluation Criterion (PIEC): Ft. Collins, Colorado

Before plans for BRT could be established, there first had to be a strategy to gain the necessary funding to implement a Mass Transit System (MTS). Fortunately for the city of Ft. Collins, it was eligible for Small Starts funding which yielded the city $11.9 million to allocate towards the project for FY 09. If it were not for this funding, the project-design phase would have come to a halt. This is just a small portion of the

overall funding that will be distributed over time towards several different aspects of this proposed BRT system.

Ft. Collins is in fact one of twenty-two transit projects that were selected for Small Starts funding. A tiny portion with an estimated amount of $59.35 million will be allocated for the complete project cost that runs around $74 million, to construct a south transit center giving high priority to traffic signal. The system also ensures to construct almost eight transit stations with numerous bus stops and 250 ride spaces. The system ensures to set accommodate an average of 3,900 passengers for daily ride once the project is completed.

Several conditions are in place for BRT to be successful in Ft. Collins. The city maintains a stable population growth rate at 1.4% and this in turn helps to facilitate growth in ridership. The city has certainly has been aggressive in receiving the funding for this project (City of Ft. Collins, 2010). Just over 80% of funding for the Mason Corridor will be coming from Small Starts funding. The remaining 20% will be covered by the taxpayers and independent donors. The city of Ft. Collins has been behind this proposed BRT system for the past three years. The city has launched an aggressive and popular marketing campaign designed to win acceptance for the project.

The media coverage has been ongoing and as the project moves forward it has become more visible. Regular town hall meetings to discuss BRT have become a staple in Ft. Collins. Initially, many citizens in the area were confused and nervous about the concept of BRT. City officials addressed these concerns and now conduct workshops to keep the people up to date as the project momentum accelerates. These officials believe, and history bears this out, that the more information available to future

commuters about Ft. Collins BRT system, the easier the transition will be for all involved.

The city was able to identify key areas of economic development within the downtown city limits. These were existing economic hubs, such as those near Colorado State University and those in the greater downtown area. These locations are highly populated nodes and are the logical choices for the establishment of a new mass transit system. Much like the previous case studies, one of the many goals includes encouraging economic development by creating these transportation corridors. With so much of the Ft. Collins population concentrated near the university and downtown district, linking the two locations with BRT is the most plausible model.

The current road infrastructure for the proposed corridor is conducive to that of a BRT system. The anticipated plan calls for two designated lanes dedicated solely to the movement of busses. Roads will not be widened, but existing lanes will decrease from four to two. Sidewalks will need to be widened in order to accommodate bicyclists and pedestrians but this is a relatively easy fix requiring a minimal cash outlay and very little time to accomplish. Since a bus system is already in place, busses will be modified to a sleeker, more attractive design which will ultimately attract more riders.

Plans for BRT: Gainesville, Florida

The city of Gainesville, Florida is a vibrant college town located in North Central Florida. It is home to the University of Florida and boasts a population of roughly 125,000 people (City of Gainesville, 2010). As would be expected, the university is one of the primary businesses within the city; the other is the Shands Hospital System. This teaching hospital has a sprawling campus with in excess of 18,000 employees. The university, with its 50,168 students and 12,722 staff and faculty members, and the

hospital system share a common area, thus creating a well traveled service hub (City of Gainesville, 2010). To meet the needs of its burgeoning population, Gainesville has formally adopted a new, long-term plan for transportation.

This innovative plan is intended to reduce private vehicular traffic on area roadways by shifting to a multi-modal plan which will incorporate the BRT principles. This college community established a public bus system, Regional Transportation System, or (RTS). This transit network contains a fleet of 120 busses, with 88 busses operating during peak hours (Figure 4-2). RTS offers transportation to and from 25 different routes throughout the city (RTS, 2010) (Figure 4-3).

Although much of the usage is predominantly to and from campus, there are many who use RTS to reach other areas throughout the city. The current system serves the people of Gainesville, but not without serious flaws and inconveniences. RTS is a growing system, and this in turn could lead to a more effective system. The expectation is that the ridership will increase, which will allow it to become a tool to spawn development along these proposed corridors.

For the proposed Bus Rapid Transit System, (BRTS), as many as eight arterial routes currently in the design and engineering phase. These plans have been in preliminary staging for over five years as of 2010 (RTS, 2010). Much of the funding for Gainesville's BRT system will come from the Very Small Starts program. Again, it is anticipated that approximately 80% of the projects costs will be covered by the federal grant program. The system will strive to use the existing RTS system, but will incorporate all of the intricacies that come with mass rapid transit (RTS, 2010).

The system will offer many of the key elements that make BRT such an efficient mode of public bus transit. Each bus will contain ITS elements that provide priority right of way, unencumbered by other vehicles. During the first stage of BRT development in Gainesville a feasibility analysis was conducted by The Center for Urban Transportation Research (CUTR). This feasibility study simply pinpointed, with great accuracy, which of the main corridors within the city limits of Gainesville would be the best option for the proposed system. The center listed several possible locations for BRT placements. Among the selected locations were: Archer Road, 13th Street, Newberry Road, and University Avenue. Each location has been recognized as being optimal locations for sustainable mass transit use (RTS, 2010).

On Archer Road, one significant factor for consideration is that this road passes in front of Shands Hospital at UF. Shands large employee and patient population must be factored into any equation for development. While there is heavy usage of the current bus system along this route, the wait time and inefficiency makes it a recipient of constant criticism. The population in recent years has seen moderate fluctuation. Certainly the student population will always need to be considered, but the city is also beginning to see strong growth away from the university. Northwest Gainesville and East Gainesville have seen significant increases in population over the last five years. This fact is empirical evidence that demonstrates the need for an upgrade in public transit.

Gainesville is planning to apply for the Small Smarts grant to essentially test a small three to four mile corridor within the city (RTS, 2010.) As of now, the two corridors that are receiving the most attention for this grant are the Archer Road and Southwest

20th Avenue areas. These are both heavily traveled corridors in desperate need of improvement. Either one or both of these roads would be optimal choices for the initial phase of the project. By considering road adaptability, practical concentrated population densities, and the existing usage of these routes by commuters they are prime locations, without question.

By comparison, Eugene, Oregon's Green Line Project is a corridor much like Gainesville's Southwest 20th Avenue site and would yield valuable insights into the feasibility of a more complex network. The Green Line Project is a 4-mile BRT corridor that cost $25 million to construct. The Green Line was funded using Small Starts, which covered most of the project costs.

If Gainesville is to receive funding it must do so by presenting a project that meets all the requirements of either Small Starts or Very Small Starts. The City of Gainesville would not qualify for New Starts funding because the size of the proposed system does not meet the basic requirements. RTS will seek financial support to initiate a testing corridor, whereby the city can implement a short term, concentrated route and monitor its function. Once the city can determine if the BRT corridor is a success, a decision will be made to request additional federal funding for new BRT corridor projects.

Applying Pre-Implementation Evaluation Criterion (PIEC): Gainesville, Florida

When analyzing Gainesville's potential for development, one cannot help but be drawn to the similarities between Gainesville and Eugene. Both are college towns with comparable geographic and population sizes. Both show annual growth, and both are eager to meet the needs of their citizens. In fact, their planning for BRT is comparable as well. Gainesville, just as Eugene did, plans to begin the process by creating a small

test corridor within the city. BRT would then be incrementally brought into the city, being built on a specified corridor or hub. This measured approach also allows the designers to revisit the proposed corridors to make certain that the need has not shifted or diminished in their proposed area. Once it is determined that the system is Just over 80% of funding for Gainesville would come from the Very Small Starts Grant source. The remaining 20% will be covered by the taxpayers and independent donors. Once it is determined that the system is sustainable in its present form, the process of linking BRT routes throughout the city would begin.

Gainesville has many pre-implementation conditions that would be suitable for BRT. The city has a stable population growth of 1.7% over the last year (UF Economic and Research Bureau, 2010). Along the tested feasibility corridors, there are strong population densities present. Shands Hospital and the local student housing provide great examples of the necessary employment and housing densities that must be in place prior to implementation. According to a lead transit planner for the City of Gainesville, Douglas Robinson, the existence of concentrated employment and housing densities are imperative when planning for BRT. When these densities are in place it allows transit planners to accurately pinpoint optimal placement of BRT. These densities serve as a perimeter for development of not only transit, but commercial and retail use as well. Large concentrations of residents remain the life source for mass transit systems, including BRT (personal correspondence with, Douglas Robinson, March 19, 2009).

As previously mentioned, Gainesville was fortunate to qualify for federal funding through New Starts Capital Investment program. The city's proposed BRT system is

eligible because the plans will entail a “fixed guide way” system. Without this strict stipulation mandated in the FTA’s 2005 transportation bill, Gainesville would not have been considered eligible for a funding allocation for this project. Since the inception of preliminary planning and design, there has been a grassroots effort from the City of Gainesville, in partnership with RTS, to educate its citizens about this innovative mass transit system. There have been numerous workshops and town hall meetings addressing all relevant questions about the prospective plans for BRT in the city.

In early 2009, RTS of Gainesville asked several transportation consultants to address the concept and development of BRT. The workshop was an informative meeting describing in detail the basic intent of BRT, while also providing extensive details. As it turned out, one of the consultants was a transportation engineer from Eugene, Oregon, Nigel Williams. Mr. Williams was instrumental in the planning and design phase for the EmX Line in Eugene and gave a comprehensive presentation outlining, in depth, how BRT worked in Eugene and what Gainesville needs to have in place for BRT to thrive. The City of Gainesville consists of several corridors that contain large concentrations of the employed and those who are homeowners/renters. Proposed corridors such as the one on Southwest 13th Street/US441 and Archer Road contain many assets that would help to sustain BRT.

Recommendations for Ft. Collins and Gainesville

As planning progresses, the cities of Ft. Collins and Gainesville must learn from previous BRT models so that they do not repeat the mistakes of the past and to allow them to accurately see the future and assess its needs. To achieve the success of a Curitiba, Bogotá, or Eugene model it is imperative that a set of guidelines be established and followed. Throughout modern history, there have been countless

instances when municipalities rush into ill-conceived construction projects, which lead to a flawed or failed venture. In the current financial climate however, it would be political suicide for a group of city leaders to undertake development which was not a guaranteed success.

By the same token, to continue to throw money at a system that has already outlived its usefulness would also be foolish. The time is now and the need is great. Imagine, if you will, connecting not just city hubs and nodes but also neighboring municipalities and eventually an entire state by utilizing a proficient transit system. The possibilities are unbounded as cities throughout the globe search for alternative methods of daily transport.

These municipalities should employ an incremental method that will afford less opportunity for error and failure. BRT, like any other type of mass transit system has to be implemented in a way that compliments and enhances existing conditions. The optimum method to achieve this is to methodically and incrementally establish the system. In keeping with this ideal, the proposed plans for Gainesville and Ft. Collins consist of relatively small corridors, extending barely four miles in total. In an effort to eliminate any possibility of a financial blunder and to allow adequate time to study the system, this becomes the best plan to follow.

Both Ft. Collins and Gainesville remain in the preliminary stages for BRT implementation. However, each municipality has fully committed itself to the future use of rapid bus transit, believing it to be the answer to their growing need for an efficient, cost-effective alternative to the system that is already in existence. The only barrier at this time is establishing eligibility for the required federal funding for the project. If

Gainesville and Ft. Collins are going to complete the planning and design phases, the BRT projects will to need to be eligible for the FTA's Small Starts or Very Small Starts program. City officials are preparing the required documentation and are remaining diligent in scrutinizing the grant guidelines to make certain that everything falls neatly in to place when the time comes (Table 4-1).

Table 4-1. PIEC Evaluation of Gainesville and Ft. Collins

PIEC	Gainesville, FL.	Ft. Collins, CO.
Concentrated Employment Densities	Shands Hospital and the University of Florida act as strong concentrations of employment density	Colorado State University and the University Hospital act as strong concentrations of employment density
Persuasive BRT Marketing Campaign	The City Gainesville has held workshops, but the marketing campaign could be more persuasive.	City information sessions, workshops
Already Existing Public Bus System	RTS system is efficient and ridership is on the rise.	Current MAX system is efficient
Adaptable Road Infrastructure	Existing road infrastructure is conducive for implementation of BRT. *Intermodalism incorporated in planning	Suitable street widths were present with initial proposed MAX corridor. *Intermodalism incorporated in planning
Must Have Sustainable Funding Source	Eligible for New Starts grant funding.	Eligible for New Starts grant funding.
Stable or Growing Population	Population has been relatively stable for last three years	Population is trending slightly to growth over the last three years

Figure 4-1. Mason Corridor Route System (Source: City of Ft. Collins, 2010)

Figure 4-2. RTS in Gainesville, FL. (Source:RTS, 2010)

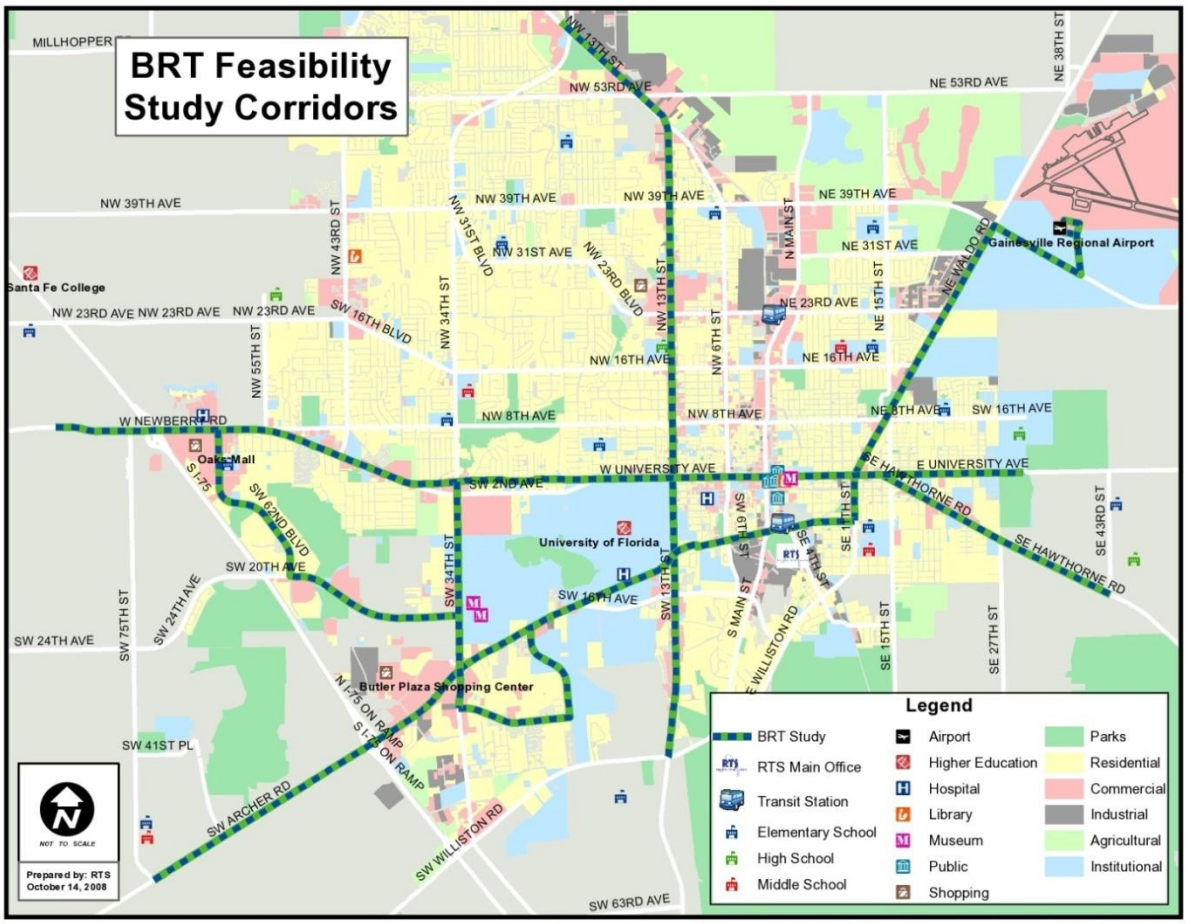

Figure 4-3. Suitability Map for Gainesville, FL. (Source: City of Gainesville, 2010)

CHAPTER 5
CONCLUSION

Throughout this study we have established that there are a number of essential guidelines required for a successful BRT venture. This study sought to acquire a PIEC by evaluating established and successful BRT systems. After the PIEC was applied to prospective BRT municipalities, an analysis can be performed as to how adaptable and effective the PIEC truly is. The one most critical factor within the PIEC is funding. BRT cannot be implemented if the capital investment is not present are not allocated. This can be from a local, state, or federal source or it from an independent donor. In all of the U.S. cases featuring BRT, federal grants have paid on average 30-80% of project funding. Certainly there will be alternative sources that could be used, but that typically will not cover all construction costs. This will provide a clear understanding as to why federal programs such as New Starts and Small Starts must continue to prevail, at least when it comes to the current economic environment.

BRT in the U.S. seems to be headed for an incremental approach. Transit planners will need to set the pace of BRT development with a preliminary perception of the present transit network and then be guided by a clear view of a preferred future network, whether it is a rail system or mass bus transit. The FTA will need to address the fundamental “mandatory corridor” focus for Small Starts and Very Small Starts transit capital investments. The hope is that this FTA program will be expanded to include a more flexible, network-wide approach as BRT becomes more acceptable to the U.S. population.

Ft. Collins and Gainesville are both ready to facilitate BRT. Although, each municipality has unique conditions from one another, they each possess the necessary

condition to implement BRT. It is apparent that Ft. Collins is further along in its planning for BRT than Gainesville. The city has completed the preliminary design and engineering stages and is currently awaiting the disbursement of project funds. Both of these undertakings have both dissimilarities and similarities at the same time. They both share relatively the same population and boundary size. Yet, the two cities are proposing two different types of BRT projects, each serving the specific needs and constraints of their city. It is simply too much to expect a city to provide all the necessary funding for any form of mass transit project, be it small or large scale.

Municipalities are already experiencing substantial budget constraints as it is. This is where our government becomes a key player via the Federal Transit Agency and its federal program funding. The government also rewards well-developed submissions and sees the advantage of undertaking the proposed enhancement using the incremental method. FTA is far more likely to allocate money for smaller projects (i.e., Small Starts, Very Small Starts) than for larger scale transit projects (i.e., New Starts), which is why the requirements are so stringent.

This study has shown that PIEC should be used for efficient and successful implementation of BRT. This is a concept which must be entered into advisedly and with meticulous forethought without the direction of those who have gone before failure is almost a certainty. Municipalities are beginning to take notice of BRT, primarily for its cost effectiveness and the ability to integrate both large and small scale systems into existing means of mass transit. As previously mentioned in the literature review, the FTA's New Starts, Small Starts and Very Small Starts programs are progressively funding more and more "fixed guide way" systems throughout the country. From the

findings of this study, it is apparent that BRT can be a multi-use system, not just for large metropolises such as Curitiba and Bogotá but for smaller cities as well. Ft. Collins, Colorado; Eugene, Oregon; and Gainesville, Florida have all demonstrated they had or have the necessary pre-implementation conditions to sustain BRT and certainly the need is there as well.

Discussion:

Painstakingly intricate planning is essential to ensure the success of this type of innovative and municipality-altering transit system the size of a BRT proposal. Once proper analysis of the characteristics mentioned can be determined in the cities of Ft. Collins, Colorado and Gainesville, Florida, the optimum city(s) for a BRT system is made based upon the eventual development of an evaluation criterion.

The FTA's New Starts, Small Starts, Very Small Starts programs are used to facilitate BRT projects. There is an obvious variation in criteria when comparing New Starts with Small Starts and Very Small Starts. As previously stated, the New Starts program typically is used to fund larger transit projects, such as a metropolis to metropolis type mass transit system, but can be used for smaller projects. Small Starts and Very Small Starts are used most frequently, due to the fact that requirements for this program are more feasible for municipalities; local governments simply do not have the capital to consider larger scale projects.

In light of the current financial crisis in this country, the coffers of the local governments have minimal discretionary funds available and are, in fact, being forced to table projects because funding is not available. This is why federal funds play a major role in the development of these BRT systems. Typically, there need to be sources of

funding in addition to governmental sources. In some instances a wealthy independent donor or group of donors may step up to provide for the shortfall: private banks, corporations, and in some cases through a transportation tax. This final option ultimately makes the city population the providers for project funding, but in order to accomplish this, it becomes incumbent upon the city officials to have the support of the citizens.

As this study concluded, although Curitiba is seen as the pioneering city for BRT, there are still significant flaws with the RIT system, albeit minor in comparison to the scale of the network. Bogotá and Eugene have recognized these defects and have made the necessary adjustments to their BRT corridors. One such defect is that Curitiba, when designing the first BRT corridor, did not plan efficiently for intermodalism with BRT. This means that on occasion one will find bicyclists using bus lanes for commuting. Although illegal, it is still occurring on a regular basis. This practice should be completely eliminated within the next year as plans are underway to provide a dedicated bicycle lane throughout the network. This was seen as a major planning blunder because it created a hazardous situation for both the busses and the bicycle commuters.

Curitiba has learned from its mistakes and made necessary adjustments with later bus lines. For instance, the Curitiba's newly constructed Green Line will be 18 kilometers long and accommodated with bicycle lanes throughout the entire corridor. The city's planning and engineering experts understand that they have an opportunity to completely reshape the city for years to come and they do not want to miss out on such an advantageous opportunity. There is a real chance for an evolution into a society that

is less dependent on the personal vehicle, and more dependent on other means of transit.

Bogotá and Eugene have learned from its predecessors and each has built a system that appears to be even more perfected then Curitiba's pioneering BRT system. This only further proves that viewing the practices of the past provides invaluable expertise and insight pertaining to BRT and its myriad of components. Just as Bogotá and Eugene studied Curitiba for its transit planning practices, the same process is necessary to understand the pre-implementation conditions for BRT in Ft. Collins and Gainesville.

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BIOGRAPHICAL SKETCH

Kevin Biegler was born in Delray Beach, Florida in 1985. As one of five children, two brothers and two sisters, he was raised by his parents George and Jamie Biegler. After graduating Atlantic High School in 2003, he attended Palm Beach Community College for a year and a half, and later transferred to Santa Fe Community College in Gainesville, Florida. It was there that he acquired his Associate of Arts Degree that allowed him to enter the University of Florida as a Junior. Kevin spent the next two years working towards his Bachelor of Arts Degree in political science with a minor in urban and regional planning. Toward the end of Kevin's undergraduate career he opted to take classes for the minor in urban planning. This is where his passion started and has never abated. He graduated in August of 2007.

Shortly after undergraduate graduation, Kevin began his master's in urban and regional planning and also embarked on an internship with the City of Gainesville as a project intern. Kevin would start school during the fall semester of 2007. After his first two semesters of Graduate School, he decided that an opportunity to study abroad in Brazil was something he could just not ignore. It was there, that he knew he wanted to focus on a specialization of transportation planning. In Curitiba, Brazil, Kevin conducted extensive research on this topic and has chosen to apply much of this research to his thesis. Curitiba is home to one of them most innovative and successful Bus Rapid Transit systems in the world and as seen as the pioneer city for this type of transit.

After coming back from Brazil, Kevin continued working for the City of Gainesville, assisting Public Works engineers in map-making, surveys, and GIS work. Since Kevin is acquiring two master's degrees from the University of Florida, the other being in Public Affairs, he decided to take some time away from work to concentrate on

the writing of both theses. In the spring semester of 2011, Kevin O'Bannon Biegler graduated with his master's in urban and regional planning. This was followed by his second master's in public affairs, for which he defend his thesis in the spring semester of 2011. When all course work was completed and his time here was done at the University of Florida, Kevin hoped he contributed to the field of transportation planning. Transportation planning is where his true passion lies. He will now hope to use his , passion, enthusiasm and skills acquired through school and work experiences to help change the world of planning.