INSTITUTIONS AS CATALYSTS FOR RAIL TRANSIT

by

MANASI MADHUSUDAN PARKHI

(Under the Direction of
John F. Crowley)

ABSTRACT

Institutions are primary generators of transit ridership as well as economic drivers (Wiewel and Perry 2008). They help feed passengers into transit, but there is not much research that places them at the center as catalysts for the development of new rail transit systems. This research will establish evaluative criteria that can be used by institutions that want to make the initial decision of selecting rail transit over other modes of public or institutional transit. These criteria will then be tested on the rail line (unused) that passes through the heart of the University of Georgia campus.

In this research, the author has used a qualitative research approach to determine and test criteria to see whether an institution can launch a rail transit project within its boundaries. Rail lines have always attracted density (pre-car as well as post-car). This research offers an innovative approach to think about providing rail transit systems to serve institutions. It provides a framework for the initial decision-making while making the choice between rail and other modes of public transit. As an example, this research will apply the evaluative criteria on the rail line passing through the

University of Georgia's campus in Athens, GA. For urban areas where bus systems are reaching their carrying capacity or the ones that want to establish new rail transit systems, institutions can make a valuable contribution by launching rail transit with the potential of future regional expansion.

INDEX WORDS: Institutional transit, campus transit, multimodal campuses, institutional catalysts

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DEDICATION

I would like to dedicate this dissertation to my parents, Mr. Madhusudan Parkhi and Mrs. Madhavi Parkhi. Their immense courage and strength to send their only daughter for higher education to a new country is unparalleled. I'm forever indebted to them for all their sacrifices to bring me to this point and for their strong belief and complete faith in my higher education efforts. So thank you, Mummy and Papa; you gave me my roots as well as my wings and for that I am eternally grateful.

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CHAPTER 1

INTRODUCTION

Institutions are an integral part of our urban areas and active participants in urban life. They play an important role in their respective regional economies and their relationship with their host cities has become an important topic of research and consideration in recent years. The number of institutions and their economic contributions have increased their local and national visibility and brought attention to their physical development and expansion efforts. There is a new understanding that the campus and the community have common concerns that need to be addressed together.

The sharp physical edge between campuses and communities is also blurring with the inclusion of new residential, commercial, office and mixed-use buildings on the institutional side. Institutions are indeed, impactful organizations within the urban planning realm. They are not merely establishments that happen to be in a city, but their founding premises and historical trajectories rest on their relationship with the host cities and their unique social, cultural, economic and physical conditions (Haar 2011). There is a clear gap in research where institutions are rarely seen as the primary drivers for local and regional planning outside their campus boundaries. Given their impact, a more inclusive stakeholder scenario with the institution and its host city needs to be studied, where the former is responsible for developing urban planning solutions that are locally and regionally workable and acceptable in the future (both, the institution and the host community benefit from such solutions). There is very limited

research that provides institutions with the blueprint to use their assets for efficient local and regional planning solutions. This lack of framework tends to further separate the institution from the host city and the surrounding communities. Therefore, institutions are always seen as "the other" entities with a very limited role in urban planning outside their boundaries.

This research will address this gap by studying the institutional role in transportation planning. Transportation was selected for this research for its ability to create a significant local and regional impact and because an institution provides "captive ridership" that can justify the start of a mass transit option. **A "captive rider" can be defined as an individual for whom transit is the primary alternative for transportation. Captive riders choose transit over automobiles because it is highly lucrative, cost effective and convenient to do so** (Hanson and Giuliano 2014).

Public transportation is vital to all institutions because of the large number of their members that need to commute within and outside the institutional boundaries (captive riders). Particularly when the host cities may take much longer to develop and operate mass transit options, the institutions can work with communities to provide public transportation much quicker (because an institution is a single decision-making body). Although institutions initiating transit that will benefit its own members and the communities surrounding them is not a new concept, it is an under-researched one (Educational Facilities Laboratories, 1980).

Institutions are one of the key generators of ridership for public transit systems in their host towns and cities. Typically, they may either choose to be part of existing public transit

systems to make traveling convenient for their members or may establish their own systems for their members. However, this research tries to test the theory that if an institution is large enough to launch public transit in a region, there is a need to establish feasibility for transportation demand and usage and framework of criteria that can assist in the initial rail decision-making. If the campus plans to grow and flourish in the near future, there is a strong possibility that there will be an increase in the number of commuters within the campus as well. Therefore, it becomes imperative that the institution should think about either expanding the existing transportation system or provide a new option for the increasing commuting population.

For example, in Athens, Georgia (home to the University of Georgia), there is a city-county and a university-wide bus system that already exists for transit users. However, given the augmenting commuter population, it has become increasingly challenging for the campus bus systems to accommodate all the passengers, especially during peak hours (Smith, "Full Capacity" 2022). The University of Georgia is gradually getting to a point where both, the road expansions as well as increasing bus frequencies will reach an optimum limit. Therefore, in order to address the problem of limited transportation networks and increasing commuters, this research will place UGA at the center of alternative transportation planning. It is crucial to investigate whether an institution, which is a primary ridership generator in the town/region, is capable of establishing a relatively new transportation solution (rail) to evenly distribute the transportation load on the old (bus) and new (rail) systems to better prepare for the future transportation demands.

1.1. Research Question

Can an institution with captive ridership serve as a catalyst for the establishment of a rail transit system?

1.1.1. Sub-questions

- What are the factors/criteria that caused cities to pursue rail transit as a transportation alternative?
- Once the cities decided to pursue rail transit, what are the evaluative criteria and the thresholds they achieved/planned to achieve to ensure the viability of rail transit?
- Once established, are those evaluative criteria and their thresholds be equivalent to those of an institution such as the University of Georgia?

1.2. Defining an Institution

Institutions are the kinds of structures that matter most in the social realm. We may define institutions as systems of established and prevalent social rules that structure social interactions. At some stage, we need to consider how institutions structure social interactions and in what senses they are established and embedded. In part, the durability of institutions stems from the fact that they can usefully create stable expectations of the behavior of others. Generally, institutions enable ordered thought, expectation, and action by imposing form and consistency on human activities. They depend upon the thoughts and activities of individuals but are not reducible to them. Institutions both constrain and enable behavior. The existence of rules implies constraints. However, such a constraint can open up possibilities: it may enable choices and actions that otherwise would not exist (for example, traffic rules).

As Alan Wells (1970, 3) put it, “Social institutions form an element in a more general concept, known as social structure.” The original institutional economists, in the tradition of Thorstein Veblen and John R. Commons, understood institutions as a special type of social structure with the potential to change agents, including changes to their purposes or preferences. The only way in which we can observe institutions is through manifest behavior.

As Searle (1995, 2005) has argued, the mental representations of an institution or its rules are partly constitutive of that institution, since an institution can exist only if people have particular and related beliefs and mental attitudes. Hence an institution is a special type of social structure that involves potentially codifiable and (evidently or immanently) normative rules of interpretation and behavior. Institutional rules are in principle codifiable, so that breaches of these rules can become subjects of discourse.

In the realm of urban planning, institutions also embody physical space. They inhabit our urban areas and draw from the resources offered by the communities around them. Therefore, they have an important physical presence that cannot be overlooked.

For the purpose of this research, we define institutions as systems that consist of one decision-making body and a central operation and collection structure, as well as a physical presence.

This is a speculative research that uses a case study approach. The case studies selected for this research are the cities of Denver in Colorado, Charlotte in North Carolina, Minneapolis-St.

Paul in Minnesota and Portland in Oregon. These cities have adopted rail transit in recent times unlike some of the older rail transit systems in the country (New York City, Boston. etc.). Additionally, all three rail transit systems in the selected cities started operating as smaller, single-line systems. The route of rail transit in Athens that passes through the University of Georgia is 5.5 miles long. Therefore, studying other similar single-line startups will assist in a more translatable research. In short, the research will determine whether the causes of rail startups in the urban context of the cities mentioned above, can be considered equivalent to those present in an institutional campus (institutional context).

The rail transit system in Denver began its operation in 1994 along a 5.3-mile track. The transportation agency (Regional Transportation District) has since then managed to expand the system by dividing the Denver metropolitan region into several zones for better transit coverage. The current rail transit system in Denver is a combination of both heavy and light rail transit. On the other hand, the rail system in Charlotte began operating more recently in 2007 and is a light rail system (no heavy rail). The Lynx Blue Line is now around 20 miles long since its inception in 2007 (9.6 miles) and provides service to the University of North Carolina's Charlotte campus. Minneapolis-St. Paul and Portland rail transit systems started as single-line rail transit as well. It will therefore be helpful to study the reasons/criteria that justified the development of rail transit in these cities and test whether an institutional setting can satisfy those reasons as well. The goal of this research is to test the established criteria on the rail line passing through the University of Georgia, which can aid in the initial decision of whether to embark on the planning of rail transit at an institutional level, based on the four case studies in an urban context. Finally, the research

will provide a framework using the criteria that can be adopted by institutions to decide whether rail transit is a workable option for their campus in the future.

As mentioned above, this research will only focus on the initiation of the first, single line rail transit system (institution as a catalyst). The implementation strategies, structures and timelines will not be a part of this research. The realm of this research lies within that initial (binary) decision an institution will need to make, to either provide rail transit or think of transportation options other than rail. Therefore, the study will not choose between heavy or light rail as that is beyond the initial consideration of whether rail transit will be developed. The next chapter in this document will elaborate on the history and background of rail transit in the United States in general as well as within the institutional context of Athens, Georgia.

CHAPTER 2

LITERATURE REVIEW

The relationship between institutions and urban planning is an important one, because the institutional response to change impacts the communities within as well as outside (Murphy 1975). Cities are willing to take the risk of accommodating the expanding power of institutions in exchange for access to their capital, managerial skills and initiative, which their own agencies, hampered by decreased federal and state funding, years of post-industrial decline and disinvestment, and a loss of public trust, cannot bring together. Increasingly, non-profits, business groups and governmental agencies are pushing them to capitalize on this potential. Institutions are enduring components of urban economies and can become leaders in enhancing urban vitality and more needs to be done so they can strengthen the cities they draw resources from (Haar 2011).

For the purpose of inclusion of all the topics and literature sources important to this research, the literature review has been divided into four categories.

2.1. Urban transportation planning

2.2. Public Transit: Buses and Trains

2.3. Rail specific research

2.4. Rail Transit Feasibility

2.5. Institutional component and university transit systems

2.1. Urban Transportation Planning

Transportation is vital to urban life because it is an absolutely necessary means to an end as it allows people to carry out the diverse range of activities that make up daily life (Hanson and Giuliano 2017). It has a significant influence on the urban spatial structure and is constantly shaping urbanization (Rodrigue 2020). Transportation has a major impact on the spatial and economic development of cities and regions (Banister 1995).

Between 1910 and 1950 in the United States, privately owned mass transit (both train and bus) companies continued to suffer at the hands of the automobile and oil corporations and lacked financial or political support. Its situation worsened post the Second World War with federal mortgage subsidies, low cost land availability and the Interstate Highway Program. Transit companies were unable to escape the problems that drove them into bankruptcy in the 1910s, and faced high labor costs, strikes, inflation, high taxes, inability to make profits and many such factors that made their operation extremely challenging (Yago 1984). However, there were many cities in the country that had taken on transit operation before the automobile boom. These cities did not want to lose the mass transit option in their urban areas and decided to bring transit into the public domain. Therefore, many cities established publicly-owned transit authorities. For example, the New York Transit Authority was established and started operating the subway system, elevated lines and municipally-owned bus lines in 1953. Thus, the transit industry, which was once a private industry that paid taxes, became a public service that absorbed tax dollars during the 1950s (Pashigian 1976).

The passage of the Interstate Highway Act in 1956, committed the federal government to fund 90% of a new 44,000-mile network of expressways. This followed the dispersal of large numbers of the population out of the cities into the existing and new suburbs. The locations where new highways were being constructed, particularly their entry and exit points, instigated extensive real estate developments, further spurring relocation outside cities. Following such suburban trends, over a decade after the passage of the Interstate Act, the population had become increasingly dependent on cars for mobility. Cities and public officials began to realize that the need for public transit had increased because of the flooding of private automobiles into the cities causing congestion and other traffic-related issues. As a response to this pressure, the Urban Mass Transportation Act was signed into law in 1964 (renewed in 1970, 1998), which provided cities and states with capital grants for upto 50% of the capital costs of transit improvements. This was not much assistance compared to the 80% of construction costs being granted for highway projects but was a step in the right direction. Subsequently in 1974, the federal transit grants were extended to cover transit costs as well. Gradually increasing financial resources for transit led to the acceleration of the construction of heavy rail metros (Cervero 1998).

The Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991 has changed the approach to the evaluation, financing and planning process for new projects (Dilger 1992). ISTEA was more than just a transportation construction act. It attempted to deal with urban and suburban land use challenges (congestion and sprawl) through congestion migration strategies, incentives to mitigate environmental impacts and disincentives for single-occupant vehicles. Therefore, environmentally sensitive, ISTEA demanded less use of single-occupancy vehicles,

compliance with the Clean Air Act (CAA) and Clean Air Act Amendments (CAAA), financial planning linked to long-term (typically 20 years) corridor and major projects identification, managing demand, using innovative financing and tolls and sensitivity toward land uses. Moreover, to make sure projects met these constraints, ISTEA had established an exhaustive planning process at both, the state and regional levels. It gave substantial planning and implementation power to the Metropolitan Planning Organizations (MPOs). Today, the MPOs not only act as project organizers, but also as the regional consciences and program negotiators (Gage and McDowell, 1995).

A high level of local accessibility and good quality public transport have always been important components of urban transportation research (Saif, Zefreh and Torok 2018). A generally better matching of transport facilities with mixed land uses and careful urban designs have resulted in an improved local environment based on public transport, bicycles and walking (Banister 1995).

Largely, due to the many policy implications, the history, growth and the overall journey of urban mass transit in the United States is the subject of constant debate (American Public Transport Association 2006). At one end of the spectrum there are those that believe mass transit, which was a thriving industry, died because it became a victim of the conspiracy between the automobile and oil industries. That both the industries orchestrated the steady decline of mass transit by increasing car dependency in order to benefit their own corporate interests and gaining a financial and political monopoly was a part of the plan (Bianco 1999).

The other end of the spectrum is of the opinion that the decline of mass transit was a result of market forces and a matter of choice (Mattioli, Roberts, Steinberger and Brown 2020). They hold the transit companies responsible as most of them could not figure out ways to sustain themselves. This opinion argues it is not a coincidence that, while almost every interurban and streetcar line in the U.S. failed, nearly every grade-separated subway or elevated system survived. Transit agencies continued to provide frequent service on these lines, so they remained viable, and when trains did not have to share the road and stop at intersections, they could also be time-competitive with the car (Mattioli, Roberts, Steinberger and Brown 2020). The subways and elevated lines of Chicago, Philadelphia, New York, and Boston are all still around, while the vast streetcar and interurban networks of Los Angeles, Minneapolis, Atlanta, Detroit, and many others are long gone. Only when transit didn't need to share the road with the car, with its frequent service continued, was it able to survive (Grengs 2010).

In between these two ends of the spectrum, most scholars emphasize the importance of policy choices, ranging from road building to taxation to traffic management, which encouraged driving and hampered the transit industry's ability to compete. But even within this interpretation, the degree to which these policies were the product of an open and democratic political system or were imposed by a small elite, remains the subject of a vital historiographical debate (Grengs 2010).

Another important debate within the transportation community is the nature of growth itself. Today, while the main goal of transit seems to be reducing urban sprawl, other important benefits that are associated with it are providing consumers with greater choices, making housing

affordable wherever possible, reducing automobile travel rates, reducing total congestion, and improving land use and transportation planning (Litman 2015). Although these goals are not necessarily mutually exclusive, they are not always viewed with the same importance. Each of the components of transit development and use has an impact on how growth is perceived and dealt with, in different regions (Belzer and Autler 2002). For example, let us consider population growth. One view accepts population growth as a given and searches for techniques to accommodate it (roadway widenings and increasing densities at transit stations). Another view believes that population growth can be controlled and looks for ways to limit it (restrictions placed by zoning). The attitude toward new development and how it should be accommodated can clearly be influenced by which view is prevalent (Miller and Hoel 2002).

As a consequence of the construction of the National Highway System, urban development patterns in the United States have changed irreversibly, diminishing the importance of having a central business district (CBD) altogether (FTA Research Results Digest 1997). There is no denial of the fact that a lot of our employment centers today exist in the city suburbs (Ehrenhalt 2012). The automobiles and highways have given both businesses and households greater locational flexibility. That flexibility has changed the character of urban development dramatically. The change has not come without cost: some parts of most urban areas have experienced increases in traffic congestion, declining environmental quality, lack of maintenance and redevelopment and sheer neglect (Giuliano 1999).

The rationale for conventional land-development policy in North America has been similar to that of transportation policy: there is abundance, not scarcity; therefore, address increasing demand by adding capacity (e.g., use more land at the urban fringe) (Newman and

Kenworthy 2000). However, continuous efforts of the cities and pro-transit activists managed to begin the transit revival in the 1950s. By the time transit began reappearing in the urban fabric, it was still not able to stop suburbanization (Divall and Bond 2003). Until the 1990's, transit was unable to make any significant changes to the urban form because it was uneconomical for it to operate in the suburbs. In the 1990's the concept of transit-oriented development was experimented with, and that is when transit began to shape urban land use substantially (Hanson and Giuliano 2004).

Transit-oriented development regulations guide development within a transit station area or corridor and communities may utilize ancillary regulations in order to guide growth into these areas and to create procedures for implementing transit-supportive land-use policies (Suzuki, Cervero and Luchi 2013). Transfer of development rights (TDRs), clustering, concurrency, and urban growth boundaries (UGBs) may be used to shape regional land-use patterns by directing growth into compact urban centers and nodes. Ancillary procedures are also needed to provide a vehicle for development approval and to ensure that public land and private sector obligations are fulfilled. Specific plans provide the link between a community's land use plan and implementing regulations. Joint development and capital improvements programs (CIPs) provide a structural framework for financing and constructing the infrastructure needed to support these land-use patterns (Freilich 1998).

One of the most common debates in land use literature is whether the transition of our cities from monocentric to polycentric is favorable. This core argument of this debate emphasizes the importance of centrality and what it means when our cities shifted from it. In a

monocentric setting (historic pattern of cities), land uses segregate themselves into concentric rings around a central node and transportation corridors emerge from the center, radially. On the other hand, polycentric development consists of multiple sub-centers with their own land use clusters. As each cluster reaches its optimal size, continued growth in the metropolitan area leads to the formation of additional clusters (Marshall 2005).

In a monocentric development, both land prices and density decrease as one moves away from the central core and there is a definite hierarchy (CBD at the center and residences on the fringe) (Ville, Hannu, Mika and Panu, 2011). Scholars on this side of the debate argue that given the constraints in production and transportation technologies, the characteristics of transportation and land development in the monocentric-city model; radial transportation, segregation of land uses, and land prices and development densities that rise with proximity to the center; are economically efficient (Ville, Hannu, Mika and Panu, 2011). Housing in these developments is more affordable. Some people decide to accept longer commutes in exchange for more comfortable, lower-priced housing (Litman 2021).

The other end of the spectrum states that polycentric developments have greater economic viability. Clusters form at the intersections of arterial streets or highways and offer especially good access to other clusters and to residential areas. The result is a metropolitan hierarchy of urban sub-centers. Every time a new cluster is created; it generates demand for greater transportation capacity into and out of the cluster. In particular, the connections between one cluster and the other clusters in the system are important. Therefore, polycentric development offers more flexibility while planning for the future (Champion 2000).

Transportation and land use seem imbalanced in our urban areas due to many reasons. Transportation planning is done at large geographic scales due to its need for a seamless network (national, state and metropolitan scales) and most times has a dedicated revenue source (Hanson and Giuliano 2004). However, most impacts of land use planning are local and planning activity itself is carried out by the many smaller units of local government with small scale and independent perspectives (Sciara 2017). Additionally, transportation agencies tend to think of immediate transportation objectives instead of stressing on long-term land development impacts (attention to land use in the context of transportation is inadequate). These long-term land use implications of transportation are addressed in local comprehensive plans. While transportation considerations have dominated policy at the regional and metropolitan levels, land use considerations should play a larger and more important role because cities in the United States have been more likely to build an urban form around a transportation network rather than the other way around (Waddell, Ulfarsson, Franklin and Lobb 2007).

Transportation and Growth

Largely, due to the many policy implications, the history, growth and the overall journey of urban, mass transit in the United States is the subject of constant debate. At one end of the spectrum there are those that believe mass transit, which was thriving industry died because it became a victim of the conspiracy between the automobile and oil industries. That both the industries orchestrated the steady decline of the mass transit by increasing car dependency in order to benefit their own corporate interests and gaining a financial and political monopoly was a part of the plan.

The other end of the spectrum is of the opinion that the decline of mass transit was a result of market forces and a matter of choice. They hold the transit companies responsible as most of them could not figure out ways to sustain themselves. This opinion argues it is not a coincidence that, while almost every interurban and streetcar line in the U.S. failed, nearly every grade-separated subway or elevated system survived. Transit agencies continued to provide frequent service on these lines so they remained viable, and when trains did not have to share the road and stop at intersections, they could also be time competitive with the car. The subways and elevated lines of Chicago, Philadelphia, New York, and Boston are all still around, while the vast streetcar and interurban networks of Los Angeles, Minneapolis, Atlanta, Detroit, and many others are long gone. Only when transit didn't need to share the road with the car, and frequent service continued, was it able to survive.

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Transportation and Land-use

The types and mix of land uses influence the demand for transit as well as the use of non-motorized modes. However, It is difficult to sort out the effects of land use mix and urban design because they are strongly correlated with density. Regions with land development with a focus on public transit have the following advantages:

- High-quality transit service that attracts riders
- Political culture that values transit
- Transit stations in areas where the market supports development
- Regional policies that focus growth in transit corridors and limit it elsewhere
- Station area policies and programs to support public-private investments and transit-friendly development
- Long term commitment to create and maintain land uses that support transit

Today, there are several land use policy support tools that help transit projects (an vice versa) such as transfer of development rights or sales taxes or establishing tax allocation districts.

One of the most common debates in land use literature is whether the transition of our cities from monocentric to polycentric is favorable. This core argument of this debate emphasizes the importance of centrality and what it means when our cities shifted from it. In a monocentric setting (historic pattern of cities), land uses segregate themselves into concentric rings around a central node and transportation corridors emerge from the center, radially. On the other hand polycentric development consists of multiple sub-centers with their own land use clusters. As each cluster reaches its optimal size, continued growth in the metropolitan area leads to the formation of additional clusters. Transit-oriented development is a form of polycentric development (Cervero 1994).

In a monocentric development, both land prices and density decrease as one moves away from the central core and there is a definite hierarchy (CBD at the center and residences on the

fringe). Scholars on this side of the debate argue that given the constraints in production and transportation technologies, the characteristics of transportation and land development in the monocentric-city model; radial transportation, segregation of land uses, and land prices and development densities that rise with proximity to the center; are economically efficient. Housing in these developments is more affordable. Some people decide to accept longer commutes in exchange for more comfortable, lower-priced housing.

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2.2. Public Transit: Buses and Trains

The choice between buses and trains is an important one in public transportation decision-making (Suzuki 2013). Each mode has its own advantages that are highly contextual. However, in recent years rail transit has gained significant momentum in the United States and has presented added advantages over buses (Cervero, Guerra and Al, 2017). The regional coverage of rail augments its importance in large-scale comprehensive planning, while buses remain limited to a local level. Rail does present higher speeds and more carrying capacities as the transportation demands of our urban areas continue to increase. In the auto centric

environment of a typical American city, rail offers more options for densification and compact planning that is multimodal in nature (Menendez, 1993).

2.3. Rail Specific Research

Post the enactment of ISTEA, there has been a growing agreement among the planning and development agencies that new, transit sensitive approaches must be encouraged in order to address the severity of primarily auto-based transportation challenges (Schiller and Kenworthy 2010). These solutions essentially call for mixed-use developments, higher development densities (both residential and non-residential) and integration of pedestrian and bike paths and transit into the land use structure. Such development approaches are assumed to allow individuals to sustain their mobility with fewer vehicle trips (Cervero, Guerra and Al 2017).

In long-term planning, the resultant impact of ISTEA implies that new capacity can be programmed when needed for the future and can be responsive to new development types and approaches (Bannister 1995). ISTEA spurred the development of many light rail transit (LRT) projects throughout the country and influenced land use around rail. Light rail emerged as a transit technology for large and medium-sized metropolitan areas in the United States post ISTEA (Cervero, Bernick and Gilbert 1994). One of the major advantages of light rail is more flexibility in location. Where land is expensive, as in a downtown area, it can be located in an existing street (which may or may not be shared with other vehicles). In most recent LRT projects, trains run through downtown at street level. The route may be a transit-pedestrian mall where other vehicles are excluded, or trains may share the street with other vehicles. The electricity for light rail comes from an overhead wire instead of a third rail. Heavy rail lines must

be designed so that people do not walk in the tracks, but light rail does not need such protection (Bruijn and Veeneman 2009).

Compared to LRT, heavy rail transit systems generally use larger and sometimes faster trains that operate below and/or above ground level. LRT generally has poorer performance characteristics than heavy rail transit, in terms of speed and regional access. Therefore, LRT's land use effects and urban development potential could also be expected to be less than that of heavy rail transit. In the cases of some urban areas, heavy rail has had a far stronger clustering influence than LRT (Cervero 2007). Another key advantage of heavy rail is that it can be easily integrated with freight rail corridor(s) to integrate movement flows of passengers and goods. Regional rail infrastructure networks can be planned to share heavy rail tracks with rail transit and accommodate freight traffic coming into the urban areas (Ozturk and Patrick 2018).

Both LRT and heavy rail have significant impacts on urban growth, land uses and development. Importantly, since rail systems improve regional access, new growth trends to cluster around station sites. However, building rail transit will not bring about major land use changes or stimulate private investments in and of itself; those goals will require plenty of development incentives and a strong public commitment to concentrated urban growth. Studies have consistently shown that rail transit can have a significant effect on shaping urban form and land use only if it is integrated with pro-development policies (zoning changes, taxation and joint development incentives). Other necessary conditions are a strong regional economy, the availability of land that can be easily assembled and developed, a hospitable physical setting

(ease of pedestrian access) and the existence of some automobile discouragements (Cervero 2007).

Transit-oriented development (TOD) is a key strategy that gained significant momentum post ISTEA (Hanson and Giuliano 2004). A TOD has sufficient density to encourage the use of public transit and it locates residences, jobs and retail destinations close to public transit facilities. A TOD consists of mixed uses, with retail and employment locations within walking distance of residential areas and is built on/along a transportation network, which is not divided into the arterial-collector-local road classification system found in most suburban areas (Cervero, Guerra and Al 2017). Most TODs contain urban design guidelines and design features in order to encourage a more pedestrian orientation, which encourages its residents to avoid the automobile in favor of more public transit (Jacobson and Forsyth 2008).

Thus, TODs not only encourage greater utilization of public transit, but also reflect a new approach to suburban development which encourages a greater variety/mix of uses than the monotonous, single-use suburban subdivision (Freilich 1998). TOD presents both a challenge and an opportunity for the transit agency. While transit agencies typically lack jurisdiction over land-use permitting decisions, they can work with local governments to encourage transit supportive land-use patterns. In addition, they can form partnerships with the private sector in order to fulfill the mandates of TOD regulations (Cervero 2003).

2.4. Rail Transit Feasibility

Rail transit is employed in several North American cities as a partial solution to urban transportation challenges (Hanson and Giuliano 2004). Rail transit does require an operational commitment for at least a couple decades to justify the investment in right-of-way, infrastructure and train cars (Phang 2007). This long-term commitment challenges the decision process and creates the need for a thorough evaluation, which includes the development of feasibility criteria (American Public Transportation Association 2006). A study conducted in the year 2000, for the Seattle area rail transit, used the following points to develop their policy decisions around rail feasibility:

- The ridership generation potential compared to a completely bus transit, assuming the incremental development of fixed-guideway systems (APTA 2006).
- Ridership thresholds in corridors and within activity centers that justify the detailed consideration of fixed guideway technology as an alternative (APTA 2006).
- The potential impacts of fixed-guideway transit segments on urban and suburban development, considering the current and forecasted land use in the region (APTA 2006).
- The extent to which feasibility depends on the availability of rights-of-way and their locations for use by fixed-guideway infrastructure (APTA 2006).
- The development of an approximate estimate of capital costs to provide a benchmark for comparison with other alternatives, assuming the incremental development of fixed-guideway transit facilities (APTA 2006).
- The importance of energy costs and relative differences among energy sources in question for fixed-guideway transit feasibility (APTA 2006).

To establish a threshold transit volume level for assessing the feasibility of fixed-guideway transit, the various studies of theoretical capacities and the actual volumes of existing systems were examined with the projected volumes of other new systems that were being implemented in other parts of the country. Thereafter, the criteria that were established covered performance and operating factors, cost factors, urban factors and environmental factors. Once the feasibility was successfully established, the alignment, station locations, system operations and connections with feeder bus transit were identified (Deen and Pratt 2010). The feasibility criteria are often divided into primary and secondary categories. The three main primary influences on the decision of whether to embark on fixed-guideway systems are:

- Physical and analytical factors—those intrinsic attributes that involve the physical layout of the system and the ridership it will serve; its costs, performance, and interaction with other elements of the transportation system; and benefits and cost effectiveness.
- Attitudinal factors—those predispositions of the community that exist independent of the plan and planning process associated with rapid-transit development.
- Financial and institutional factors—those institutional arrangements that dictate the constraints within which the system is to be financed

The secondary influences to the decision include environmental, social and factors. The social and environmental aspects of public transportation are a part of the sustainable transportation literature. Transportation, as a core component supporting the interactions and the development of socioeconomic systems, has also been the object of much consideration as to what extent it is sustainable. Sustainable development applied to transport systems requires the promotion of linkages between environmental protection, economic efficiency and social

progress. Under the social dimension, the objective consists in upgrading standards of living and quality of life. Under the environmental dimension, the objective consists in understanding the reciprocal influences of the physical environment and the practices of the industry and that environmental issues are addressed by all aspects of the transport industry. Social indicators include equity and fairness, public health, community livability, cultural and historic values, transit advocacy, etc. Environmental indicators include checking on overall pollution/emissions, including climate change mitigation in long-term planning of the system, biodiversity and habitat protection and landscape and facility aesthetics (Black, Paez and Suthanaya 2002).

The process of developing the feasibility criteria entails trade-offs between capital costs, operating efficiencies, environmental impacts and land development effects. Criteria are required to compare these alternatives and determine the best combinations of these characteristics as measured against the goals and policies established by the community to be served by rail transit (American Public Transportation Association 2006). The literature related to rail transit feasibility, currently does not go beyond the identification and analyses of the criteria. This research will try to address that gap by not only identifying the rail transit evaluation criteria, but also apply it to an existing, unused rail line that passes through the heart of the University of Georgia campus, in Athens, Georgia, in order to make it translatable to other feasibility studies for new transit options.

2.5. Institutional Component of Transit and University Transit Systems in the United States

This research focuses on institutions and their uniqueness to be catalysts for transit projects. For the purpose of this research, we define institutions as organized land-uses with captive riderships that possess centralized decision-making and collection frameworks. The case study for this research is a university, which is a type of institution with ridership that can be captured by existing and future transit.

Colleges and universities have unique transportation needs. Educational institutions value a walkable, green campus where buildings are in close proximity to foster academic collaboration. Universities can expect a fairly steady flow of commuters throughout the day since classes begin throughout the day, whereas cities expect spikes in transportation demand during rush hours. Universities are experiencing rising costs for constructing and administering transportation infrastructure, which detracts from the university's primary mission of academics. Creating a modal shift away from automobiles is an important goal for many institutions of higher learning today. Universities are in an excellent position to experiment with and implement transportation policy changes (Bond and Steiner 2006). Universities have complete control over the road network, parking facilities, and land uses on their campuses. These policy changes can enhance not only the sustainability of the university's transportation system, but also the surrounding community's. Land use, travel patterns and centralized policy control found in college and university settings often result in university communities demonstrating innovative solutions to provide transit and other non-automobile solutions to address contemporary mobility issues. Many campus communities, both in traditional college towns and in large urban areas,

have implemented or are studying policies to manage parking, provide transit and shift mode choice (Miller 2001).

Recent interest and activity in campus transportation systems stems from a number of factors, including the increased growth of many colleges and universities, growth that strains parking and claims space for new educational facilities while increasing traffic and congestion. The middle to late 1990s have also been a growth period for campus transit systems, because those university communities desiring to increase transit services have had access to increasing federal and state transit funding. The 1991 Federal Intermodal Surface Transportation Efficiency Act (ISTEA) increased authorizations for public transit capital and operating assistance, especially for smaller urban areas. TEA-21 (Transportation Equity Act for the 21st Century) continued this higher level of federal funding, at least through 2003. This increase in federal funding has been accompanied in many cases by increased state funding. The funding available to transit systems in college and university communities has given these systems the resources necessary to consider unlimited access transit that requires significant expansion of service. Transit agencies also recognize that university students, faculty, and staff represent very large and stable markets for their transit services. This market is especially important because it represents a major growth market relative to other transit market segments. Campus communities are uniquely suited to experiment with creative ways to meet these objectives because the university administration controls transit, land use, and parking. Therefore, trade-offs between transit and parking, or parking and educational facilities, can be implemented rather than just proposed and discussed. This centralization of control has led to innovative transportation demand management programs (Miller 2001).

Most university transit programs seek to increase student mobility to provide more housing and employment options and to reduce the overall cost of education. Campus communities are uniquely suited to experiment with creative ways to meet these objectives because the university administration controls transit, land use, and parking. Therefore, trade-offs between transit and parking, or parking and educational facilities, can be implemented rather than just proposed and discussed (Miller 2001).

The decision to use transit is in large part based on the transportation demand management policies in place; the most important of which are transit service improvements, parking restriction, parking pricing, and unlimited-access transit. The decision to use transit is also based on the habits, attitudes, and beliefs of the user. Experience with high levels of service transit may influence future behavior, since psychologically the experience was a positive one. Therefore, exposing students to alternative modes could have lasting impacts on the nation's transportation system. Additionally, there is also the argument that creating a "green," sustainable and multimodal transportation system on a university campus could make lasting impacts on the travel behavior of graduates (Brown, Hess and Shoup 2003).

Institutions are decision-making bodies and they require frameworks to operate within. There is a need for a framework for institutions that want to address their transportation demands while serving the communities that surround them (Haar 2011). Although rail transit may be lucrative, institutions need an initial path to review their options before deciding to plan for it.

2.5.1. Institutional autonomy (specific to universities)

The university is a significant source of received knowledge or wisdom, the primary site for the debate of over change in the intellectual order and an incubator for revolutions in science and technology. Just as important, the university is considered a center of culture, aesthetic direction and the moral forces shaping the "civilized" society. Universities also contribute in important ways to the economic health and physical landscape of cities, serving as all but permanent fixtures of the urban economy and built environment.

Such contributions to social formation, however, have not left the university in an unambiguous position relative to its urban environment. Almost from the beginning, the relationship between the university and its surroundings has been as conflicting as it has been important - captured most commonly in the timeworn phrase of "town-gown" relations. In part this is understandable, since the university as a site of knowledge has often seen itself as something of an enclave, removed enough from the immediacy and demands of modern life to produce the knowledge and information with which to better understand society and the science and technical inventions that ultimately transform it. However, this theory has been tempered in return by a new, more modern and equally historically grounded tradition that views the university in quite different terms: as a product of its relationship with the city and its urban surroundings, with a strong belief "in a university *of*, not simply *in*, the city.

The search for knowledge (and engagement), the production of knowledge, and the training of society occurs in large, complex, physically expanding and economically important environments. Universities consistently rank among the top employers in metropolitan areas and

in the case of university towns, they are a city's top employer. Universities are also among the largest and most permanent sources of land and building ownership in the town/city.

The claims of campus development and expansion are often practiced as, or at least, perceived to be, decisions made in relative institutional isolation, mirroring pastoral traditions of campus and ivory tower. University developers acquire land, build structures, that contribute to a campus, responsive to the core mission or demands of the "ways of knowledge", the disciplines, the sciences and the new modes of discovery they require and the technologies they fuel. Universities find their main constituencies in their faculty, students, staff, alumni and donors and their first development responses are those that meet the requirements these constituents have for the campus.

Against such internal logic of development is an equally evident external logic. Because universities are among the largest landowners and employers in cities, as well as major consumers of private goods and public services, they have a host of external constituents. Therefore, the role of the urban university is an important and complex one - mixing the institutional demands of both academy and city.

If there is some semblance of academic and professional tradition to be found in past university development practices, it is most likely in the scholarship and practice of campus design and planning. And if there is a single term that seems to capture the logic of university development practice, it was and remains the term "campus" the Latin word for field. Thus, campus became common as an expression for an ensemble of buildings for higher education.

Historian Thomas Baker takes these notions of university as campus further. He suggests that in the all but universal adherence to the developmental principle of the campus, American Universities, even the urban ones, came to embody the tradition of "Anglo American pastoralism" - where the academic mission is carried out in and around the "green" or the "quad" - a setting that links faculty and students to their respective disciplinary buildings and dorms, but keeps them unlinked and away from the city (Bender 1988). Thus, the campus and its planning, argues Paul Turner (1984), is the thoroughly American tradition of university architecture and design, albeit a decidedly anti-urban one (Bender 1988).

During the era of educational reform following World War II, the tradition of campus planning as the ideal form of university urban development became something of a science. Ironically what started as essentially a figment of American anti-urbanism, became the paradigm for postwar urban university development. Richard Dober, in his seminal 1963 book *Campus Planning*, describes how university campuses are built through "logical building increments" or academic, housing, or administrative units, laid out in large settings and of a scale to facilitate pedestrian-automobile linkage. Above all, this new campus, argues Dober, must be "green - providing relief from the communal life of the institution and removal from the stress of the general conditions of modern society."

Writing more recently, Dober continues to describe the ideal landscape of university development as a "green carpet upon which buildings are placed or articulated as a device to extend a building design concept into open space, with a garnish for an architectural feast." As such the campus green remains, for university planners like Dober, a central feature of university

land development. It serves as a signature element in the strategies "*to make colleges and universities better be able to "attract and retain faculty and students, advance educational and research programs, energize fundraising appeals, demonstrate environmental concepts and ethics and strengthen the campus as a community design asset"* (Dober 2000).

It follows, therefore, that university development informed by such ideals, could easily exacerbate historic town-gown conflicts, often running at odds with the broader urban and community development agendas of the city. The development requirements of the modern urban campus are no longer served by a developmental celebration of traditional American pastoralism. The notion of campus is changing and the ways it is planned and built reflect new needs of the communities - both academic and urban - that study, work or live in and otherwise use university-owned buildings and land.

There are many reasons for these changes. First, the campus tradition, built as it has been on a model of the university separate from its surroundings, created the potential for long-term, serious conflict between the university and its neighbors. It is not uncommon to hear communities angrily critique universities for their imperious, unresponsive development policies and intrusive real estate impacts. Second, university capital requirements increasingly dictate that real estate development projects be mixed-use in nature - blurring the edge of the old campus and the purposes of new buildings, creating projects that are part academic and part commercial and making the traditional notion of the campus more a thing of the past. Third, university development projects today are often projecting of community and city redevelopment as well as

educational projects. As a result, it is not uncommon for city-wide planning, design and development goals to become key elements of university development plans.

In short, university real estate practices may be driven by internal goals of campus design, academic program needs and endowment, but there are very few projects on campus that do not register an impact on the city. Successful development on campus requires responsive collaboration with their residential and commercial neighbors.

The contemporary research university is itself a community of communities - multiple colleges and departments bound together by a campus bureaucracy. The university primarily attempts to meet the demands of competing colleges and departments. When the leadership of any research university looks beyond the immediate campus, it also attends to the responsibilities of the communities that are outside its boundaries but are heavily impacted by it.

Urban settings pose a special challenge for campus expansion because universities must plan and build in areas that already are densely developed. Implementation of the pastoral campus ideal, with low-rise buildings and ample open space, is constrained by high land costs, proximity to neighboring property owners and residents, and city officials for whom universities represent but one of many corporate-institutional constituents. The communities outside the university boundaries often resent what they view as the institution’s privileged position and disregard for their well-being, both of which conspire to limit their access to university resources.

While the university leaves a large footprint on the urban landscape, it also generates economic impacts that spread across the region and the globe. Its influence increases the number and demands of potential stakeholders, which include a large assortment of neighborhood associations, donors, employees, students, governmental units and vendors. University administrators are in the difficult position of balancing and prioritizing the multiple and sometimes competing interests of these stakeholders.

Those university employees and officials responsible for planning, negotiating and implementing development projects should consider significant responsibilities not only for their own conduct, but also for the broad impact of their policies and practices. The university may possess similar legal status as large corporations, but the university often enjoys greater public authority. This authority flows from a mission that involves much more than providing educational services; universities are responsible for nurturing creative arts, harboring intellectual freedom, inspiring public service, subsidizing innovative research, etc. This authority also imposes obligations on the university administration when it acts to improve the physical infrastructure of the campus. In sum, university dealmakers need to do more than meet the conventional standards of good real estate practice; they also need to draw upon the norms that give the university its civic authority and status.

Moreover, many believe that public universities should be held to even higher standards of conduct. Their missions to serve broad public interests are legislated by charter, particularly in the case of land and sea grant universities. They receive tax revenues and special legal considerations that, for example, allow them to issue debt at rates lower than other corporations.

Such benefits and privileges support the notion that the public university should make special efforts to accommodate the greater diversity of demands articulated by those affected by its conduct.

2.5.2. Three ethical norms and two guiding principles:

Ethics refers to the values different university officials and employees use to guide their conduct in making deals. Ethical conduct is situational; it is negotiated by deliberation among a shifting set of stakeholders inside and outside the university. People act ethically within the framework of institutional roles that combine moral and political considerations.

When the university and its employees or contractors engage in development and infrastructure decisions, they should pay close attention to three particular norms: legitimacy, efficiency and fairness. These norms correspond to three overarching questions:

- Does the decision fit the basic purposes of the university and those it serves?
- Does the decision offer good market value for the university as a competitor in the real estate market?
- Does the decision treat the relevant parties fairly?

Translating these values into the complex web of relationships among different stakeholders requires principles to foster organizational and social trust and agreement. We think two principles are especially important for building trust: reciprocity and transparency. No matter how ethical an individual university negotiator may be, if important members of the relevant stakeholder groups do not trust them, resistance is likely to ensue. Universities, especially public universities, enjoy special powers and authority because people believe that the university administration will act in ways that take the interests of others and of a greater good into account.

Yet the very size and authority of universities makes it difficult for different stakeholders to fully submit themselves to such authority - especially in a society with strong democratic traditions.

Applying the principles of reciprocity and transparency anticipates the problems of organizational indifference and complexity. Reciprocity requires that all partners achieve some form of mutually advantageous exchange through sustained cooperation. It does not imply that development partners start out from similar positions of power (or equal footing), but that they agree upon the distribution of benefits as well as the conditions that must be satisfied before those benefits are realized. Transparency requires that information channels allow partners to comprehend the interests, intentions and capabilities of each partner. It does not mean that all the information is disclosed indiscriminately (which, in fact, may constitute a dereliction of fiduciary duty), but rather that information be relevant, actionable, and delivered on a timely basis.

Additionally, this approach emphasizes practical deliberations that improve the legitimacy, efficiency and fairness of the deal among the relevant stakeholders. Good university decisions may flow from the enlightened self-interest of intermediate negotiators, but few people touched by such deals want to rely on this ideal alone. Negotiators and stakeholders create more ethical deals when their collaborations put principles of reciprocity and transparency to practical use, clarifying how the intentions of the university translate into more legitimate, efficient and fair improvements for relevant stakeholders.

The main reason universities engage in infrastructural development projects is that they need additional space for their core activities. They represent a major commitment by the higher

education institutions and are undertaken only with the large amounts of public funding and political support.

Leadership

Given the complexity of real estate development, it is not surprising that strong leadership seems to be a critical success factor in many infrastructural projects and their decision-making. The preferences of the person in charge (usually the chancellor or president) will affect the type of projects undertaken and how relations with the community, the city or the private sector are handled. Regardless of preferences or styles, commitment to the project is often essential to get it completed at all. Reference CATS example.

Internal Structure

Key issues regarding internal structure are whether there is enough in-house expertise and whether decisions can be made quickly enough. Especially for institutions operating in robust real estate markets, rapid decision-making and considerable delegated authority are essential. Public institutions may be at a particular disadvantage in this regard, as public boards are more likely to restrict authority and impose limitations. Clearly the ability to develop and sustain internal expertise depends in part on the size of the institution and its real estate operations. Having considerable expertise in-house is advantageous. One advantage of in-house expertise is that learning takes place over time and that it is easier to develop a decision-making system that is responsive to market conditions while still remaining accountable. At the same time, having some separation between the daily operations of the university and its real estate arm may make sense in some cases.

Partners and Intermediaries

In undertaking their projects, universities may have the option to do so acting alone, to partner with one of more private developers, or to devolve the authority to undertake a set of projects entirely to an intermediary. The main justifications usually offered for working with private developers are that universities lack the expertise, the private sector can move more quickly and cheaply, or the private sector can provide capital. In the latter case, however, universities generally can borrow at better rates than private developers. In the first case, expertise can probably be acquired more cheaply and reliably by hiring consultants or owner representatives than by obtaining it from a development partner who has their own interests at heart. Thus, cases where a private developer can act more quickly or at a lower cost are the most reasonable opportunities for partnerships.

Relations with the Neighborhood

Conflicts between universities and their neighborhoods are generally the first thing people think about when the topic of university infrastructural development occurs. Town-gown tensions are as old as universities themselves. A typical model followed by universities that care about the town-gown relationship includes:

- The university develops a plan for infrastructural development
- The community is given the chance to raise concern/opposition
- The university forms an organizational structure and establishes some process to deal with community concerns and negotiate
- The project is modified and implemented (or canceled)

- The process or structure for community-university interaction atrophies, until a new project comes along
- If too much time has elapsed, or significant leadership changes have occurred, the process starts all over
- If the time lapse is short and there is good institutional memory, the next round may be smoother.

Given that development intermediaries themselves may not be shielded from community conflicts and given the relative instability of other formal intermediary structures, universities may be just as well off to establish advisory committees for particular purposes and projects. They may require less start-up time or staff support and may be more flexible and adaptable in the long run. The history of university-community relations, the image of the institution, neighborhood politics and the strength of the structures and processes that shape these relations may be far more important than the actual conditions of land availability.

Relations with City Government

One of the main areas of contention between universities and their local governments is taxes, services and the degree to which universities are subject to local ordinances and regulation. It is ultimately the university's responsibility to create and foster good relationships with the local political, business and civic officials. Universities are the largest employers in many places and very significant providers of external funds, cultural opportunities and athletic facilities and entertainment. Universities may also be a key but less viable source of entrepreneurship and other forms of economic development. Both the city and the university

need to wrestle with the overarching role of the university as the knowledge economy and what that means for the physical and real estate/consequences thereof. In most cases though, projects proceed in a piecemeal fashion and cities treat the university like any other organization that needs building permits and other municipal services. In most cases, contacts are project and task-oriented and episodic, rather than continuous, comprehensive and strategic (how city planning occurs and operates in general). Given the importance of universities to their cities and the importance of local government to university projects, it would make sense for both to engage in more systematic, continuous and comprehensive joint planning.

Some conclusions about universities:

- The primary motivation for university infrastructural projects is the need for additional services, facilities or space.
- The universities need to invest in long-term commitments in order to be inclusive of the communities beyond their boundaries.
- Most major infrastructural development projects require persistence and strong leadership at the highest level. Where it is lacking, success is less likely or takes longer.
- Undertaking major projects requires considerable in-house expertise and the ability to make decisions quickly.
- The creation of formal intermediary organizations for planning or development purposes may prove worthwhile as these advisory bodies provide more flexibility.

CHAPTER 3

BACKGROUND AND HISTORY

In this chapter, the author will discuss the history of transit in Athens, Georgia. This will give the reader a clear picture of the context of this research.

Transit-oriented development (TOD) is a key strategy that gained significant momentum post Intermodal Surface Transportation Efficiency Act of 1991. A TOD has sufficient density to encourage the use of public transit and it locates residences, jobs and retail destinations close to public transit facilities. A TOD consists of mixed uses, with retail and employment locations within walking distance of residential areas and is built on/along a transportation network, which is not divided into the arterial-collector-local road classification system found in most suburban areas. Most TODs contain urban design guidelines and design features in order to encourage a more pedestrian orientation, which encourages its residents to avoid the automobile in favor of more public transit. TODs are designed to accomplish several key objectives:

- Encourage residents and workers to utilize public transit rather than the automobile as a primary means of transportation
- Minimize congestion on surrounding roadways
- Increase pedestrian utilization of streets, sidewalks, and other transportation facilities

Thus, TODs not only encourage greater utilization of public transit, but also reflect a new approach to suburban development which encourages a greater variety/mix of uses than the monotonous, single-use suburban subdivision. TOD presents both a challenge and an opportunity for the transit agency. While transit agencies typically lack jurisdiction over land-use permitting

decisions, they can work with local governments to encourage transit supportive land-use patterns. In addition, they can form partnerships with the private sector in order to fulfill the mandates of TOD regulations. TOD regulations:

- Govern the amount of development because they tend to permit higher densities of development proximate to transit stations.
- Govern the type of development by permitting a land use mix within an area
- Are spatial as they attempt to minimize the distance between intensive land uses and public transit facilities, thereby encouraging persons living or working in the area to utilize transit facilities.
- Are relational because they use innovative urban design guidelines to insure not only compatibility between mixed land uses, but also that those land uses relate functionally to the transit system.

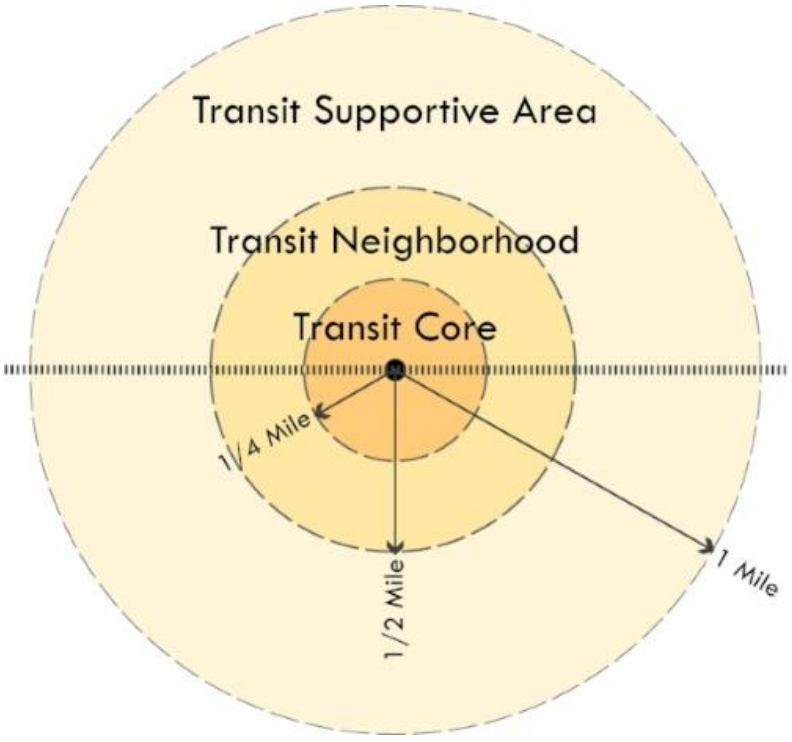


Figure 1: Basic diagrammatic representation of transit-oriented development (TOD)
Image source: https://www.citiesthatwork.com/florida-tod-inventory-map-2017

TOD regulations guide development within a transit station area or corridor, communities may utilize ancillary regulations in order to guide growth into these areas and to create procedures for implementing transit-supportive land-use policies. Transfers of development rights (TDRs), clustering, concurrency, and urban growth boundaries (UGBs) may be used to shape regional land-use patterns by directing growth into compact urban centers and nodes. Ancillary procedures are also needed to provide a vehicle for development approval and to ensure that public land private sector obligations are fulfilled. Specific plans provide the link between the community's land use plan and implementing regulations. Joint development and capital improvements programs (CIPs) provide a structural framework for financing and constructing the infrastructure needed to support these land-use patterns.

Thus, it can be seen that mass transit has come a long way since its revival in the 1960s and its popularity continues to grow with every passing decade. Although it still remains an industry defined by public ownership, high set-up, operation and maintenance costs, mass transit is very much a vital component of metropolitan America, which continues to evolve and reinvent itself.

3.1. The Institutional Narrative

The post-World War II American city was a space at once unsettling and full of promise. The late 1920s to the late 1940s had been a period of stagnation; lack of maintenance and funds for improvements and growth during the Great Depression and a reprioritizing of the economy during World War II had left the physical fabric of the cities in a state of decay. To add to these deteriorated conditions, in-migration, particularly by those looking for industrial jobs in northern

cities and the return of war veterans led to overcrowding. Yet new ideas of urbanism, articulated prior to the war and now put into effect through new federal legislation aimed at the development of highways, public housing and suburban growth, envisioned a new form of city. American downtowns would be rebuilt along principles derived from European theories of urban design developed between wars, modified to address American interests of corporate and governmental development determined to fight "blight". These ideas for the development of the twentieth-century city were radically opposed both to the unregulated growth that characterized nineteenth-century cities and to the Beaux-Arts principles articulated by City Beautiful plans.

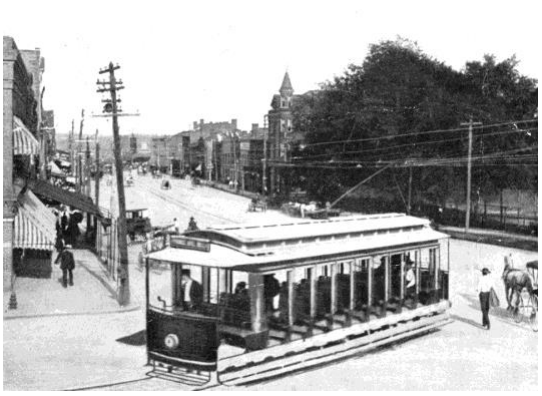
Although one city and its cultures were disappearing, new ones were emerging. Middle-class families, encouraged by inexpensive land, reasonable mortgages and the accessibility provided by cars and new highways - were choosing to leave the inner city and many businesses were choosing to follow them. After a period of postwar overcrowding in the 1950s, the populations of American cities began to decline even as the densities of their regions began to increase. At the same time, urban governments began massive projects of urban renewal in the form of public housing, highways and downtown redevelopment. Part of this larger project was the expansion of urban higher education. The postwar baby boom, new technologies and the move toward a postindustrial economy created a need for new elementary and secondary schools and by the early 1960s, the baby boomers required a higher education. The shape of the institutions that grew to accommodate these students would be of a piece with urban changes surrounding them.

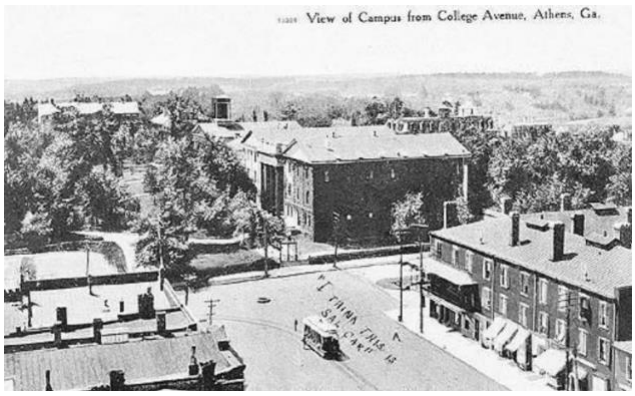
American universities in particular, grew at a phenomenal rate in the mid-twentieth century, fueled first by the Servicemen's Readjustment Act of 1944 (the GI Bill of Rights), then by the baby boom, and finally by the realization that higher education was becoming a requirement for participation in the postindustrial society. Universities grew; they confronted new technologies, cold war politics, increased budgets for scientific research under the National Defense Education Act (NDEA), economic shifts and new social and cultural environments (Haar 2011).

There was a beginning of a new relationship between the city and the university based on the common mission to acknowledge and accommodate diverse people, ideas and technologies and to advance knowledge directed toward global interactions.

3.2. Context: Athens, Georgia

The town of Athens has a rich transportation history as it is one of the towns in the state of Georgia and the United States that operated a streetcar system (1891-1931). The street cars, which began operation in 1891 in Athens used electric trolleys and were discontinued in 1931. When in operation, the streetcar trolleys followed the "downtown loop" traveling back and forth from Prince Avenue, Pulaski Street, Hancock Avenue and ultimately turning on Broad Street to head back and another route diverged from Hancock Avenue off to Lumpkin Street. After a couple decades of not having any public transportation system, the University of Georgia's UGA Transit set up bus service on campus in 1966. Thereafter, the city-owned Athens Transit started bus transit (on and off campus) in 1976 and both the bus transit services operate to this day.





Figures 2 and 3: (left) Streetcar on Broad Street, Athens GA (source: Red and Black https://www.redandblack.com/guides/athens/visitors-guide-a-classic-city-history-lesson/article_0a60b95a-9dff-11ec-a556-8fc25f417325.html and (right) streetcar on College Avenue (source: UGA Special Collections Library)

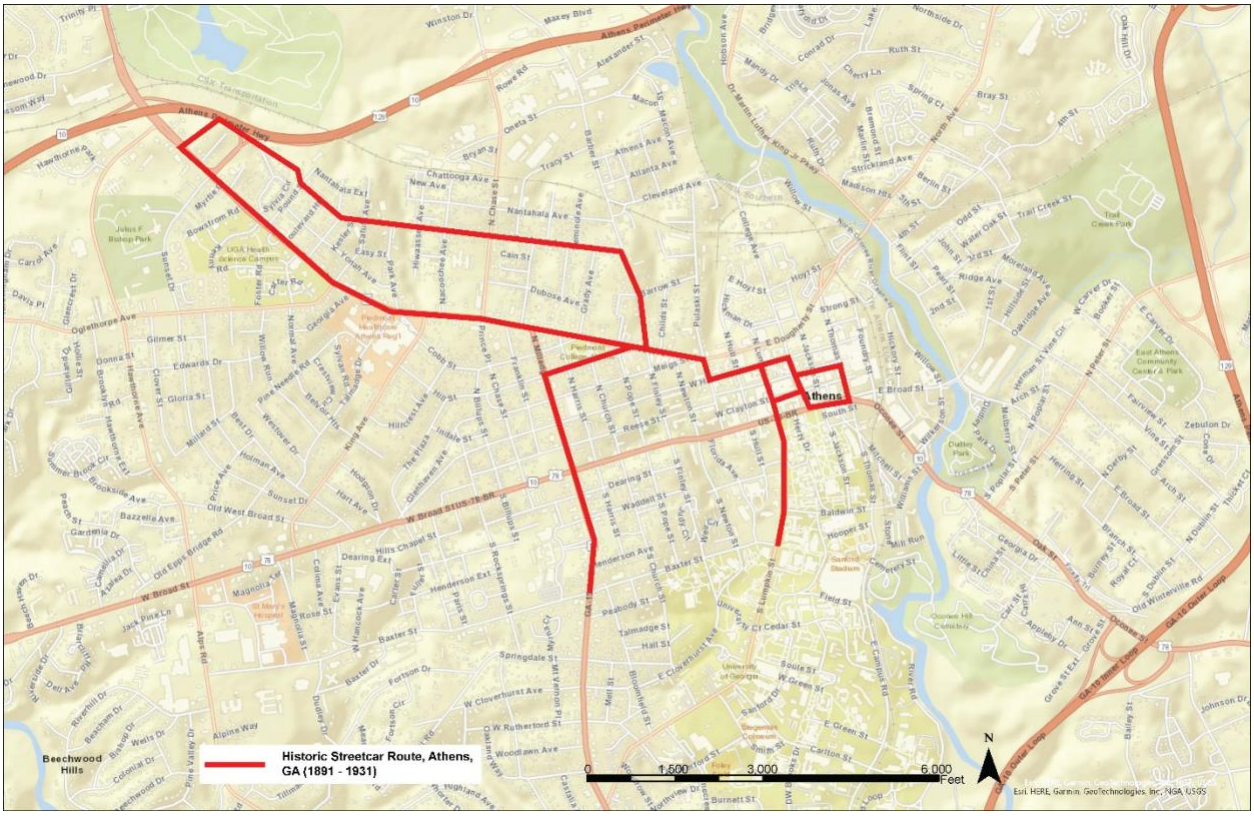


Figure 4: Map of the historic streetcar route in Athens, GA (1891 – 1931)
Map is recreated by the author based on text descriptions and documentations of the streetcar route.

3.3. Longer-Range Rail Context

One of the suggestions for the 1996 Olympics in Atlanta was to connect the Olympic venues in Athens to those in Atlanta by a commuter rail transit system, which was not implemented. Commuter rail development has since been a struggle between a general resistance to it and priorities which tended to favor earlier implementation of connections to Atlanta's south. The connection to Athens remains as one of the important alignments from Atlanta. In fact, some of the expansion plans for the Metropolitan Atlanta Rapid Transit Authority (MARTA) connecting to the Emory and Center for Disease Control (CDC) area of Atlanta will also serve some of the eventual commuter corridor development. The project to connect Clayton County to MARTA at Ft. McPherson with an initial commuter segment, which includes the international terminal side of the Hartsfield Jackson Airport is a key piece of what can eventually serve Athens.

Meanwhile, high-speed rail studies and research is advancing to connect the major cities in the southern and eastern United States (by forming a high-speed rail corridor). In this connection, Washington DC will connect to Charlotte, Charlotte to Atlanta and Atlanta to Birmingham. Between Charlotte and Atlanta, the decision-making agencies had the option of picking between three route options for the high-speed rail:

- The Southern Crescent Amtrak route
- The Greenfield corridor
- The rail corridor along I-85

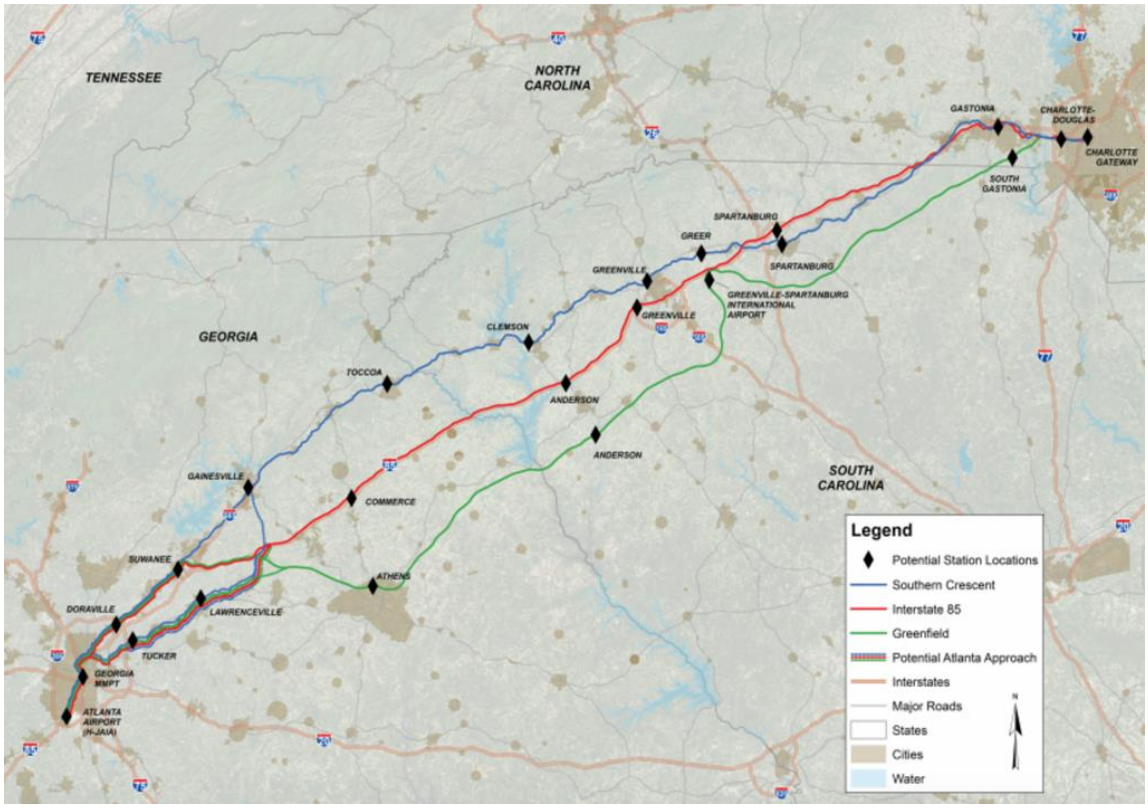


Figure 5: All the three high-speed rail route options between Atlanta, GA and Charlotte, NC. Image source: https://www.railwayage.com/passenger/intercity/atlanta-charlotte-high-speed-rail-project-moving-forward/

The Georgia Department of Transportation (GDOT) and the Federal Railway Administration (FRA) worked with stakeholders in North Carolina and South Carolina in order to decide a preferable route. FRA identified the Greenfield Corridor as the preferred corridor alternative based on their own analyses and input received from the public, stakeholders and agencies during public meetings and the comment period. The 274-mile Greenfield Corridor connects Charlotte (Charlotte Gateway Station) and the Hartsfield-Jackson Atlanta International Airport (see map above). Two stations in South Carolina, three in North Carolina, and five in Georgia could be included.

"The projected increases in population and economic growth for the Piedmont Atlantic Megaregion create a need for a carefully planned approach to improving rail infrastructure that will benefit Georgia, South Carolina, North Carolina, the southeastern United States and the nation."

- FRA in its environmental impact report

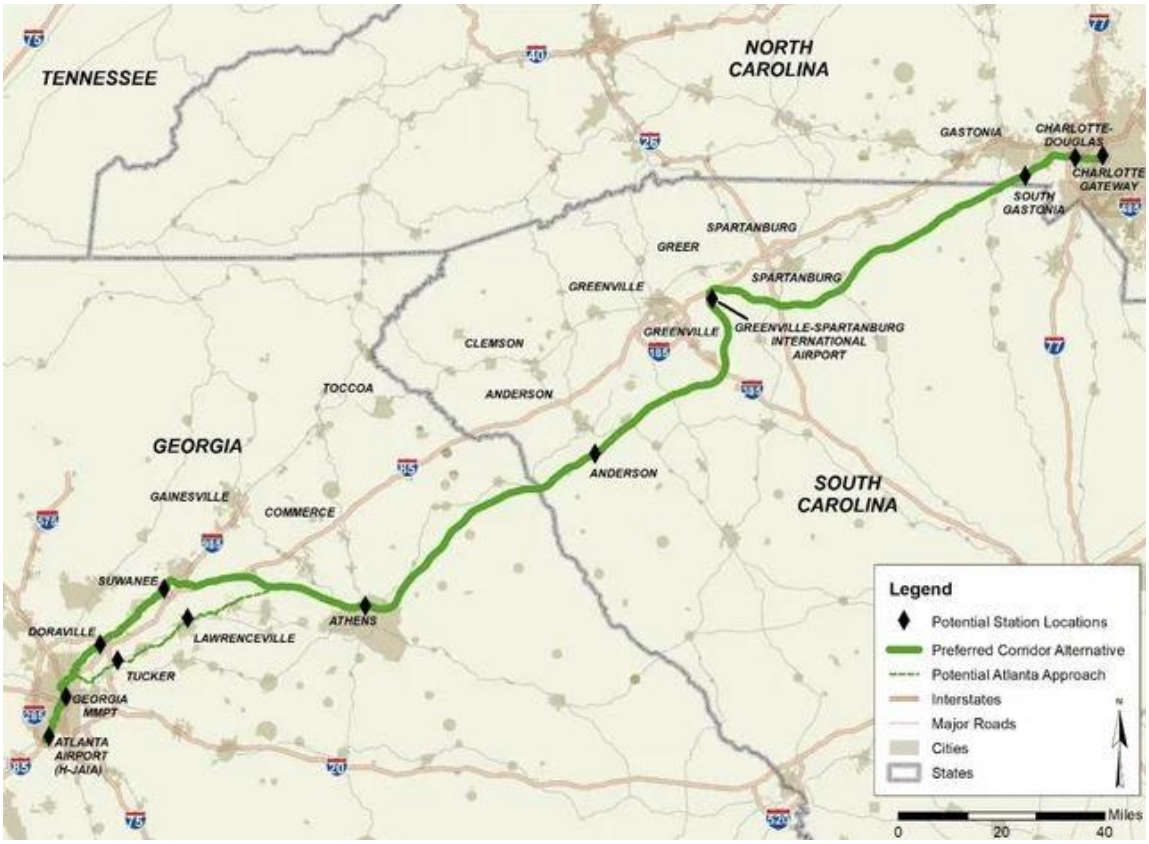


Figure 6: The selected Greenfield high speed rail line connecting Atlanta and Charlotte (274 miles). Image source: https://www.onlineathens.com/story/news/2021/07/13/high-speed-rail-line-would-connect-atlanta-and-charlotte-via-athens/7956790002/

Athens, Georgia is one of the routes on this Greenfield high-speed rail corridor. It also revives the hope within Georgia to have a train service that connects the universities in Atlanta, Athens and Augusta ("the brain train" was a concept introduced in the 1990s). Athens-Clarke

county has also built its Multimodal Transportation Center very strategically on a rail line in the hopes of a future “brain train”. It is important to look at this larger context as a future reinforcement of the logic to build a more locally-connected system that the larger one will depend on, to make its Athens terminus work. In the meantime, the local version of rail transit will very effectively serve an Athens-UGA transportation market and needs.

Compared to other larger cities in Georgia like Savannah, Augusta, Columbus or Macon, Athens is nowhere near as large in terms of its overall area. However, the uniqueness of Athens lies in the presence of the University of Georgia right at the edge of its downtown. The institutional edge meets the urban edge thereby providing a large, steady and captive/target population.

3.4. Local Railroad

There is a Norfolk and Southern (N&S) alignment that travels southward from N&S mainlines to the north near Gainesville and eventually linking to other N&S lines south of Madison near Shady Dale. Although Norfolk and Southern contends that it may need this alignment as a potential freight bypass if Atlanta gets congested, the track has been purchased between Madison and Center, Georgia, a 38-mile underutilized stretch of track by Hartwell Railroad, a local short-line operator.

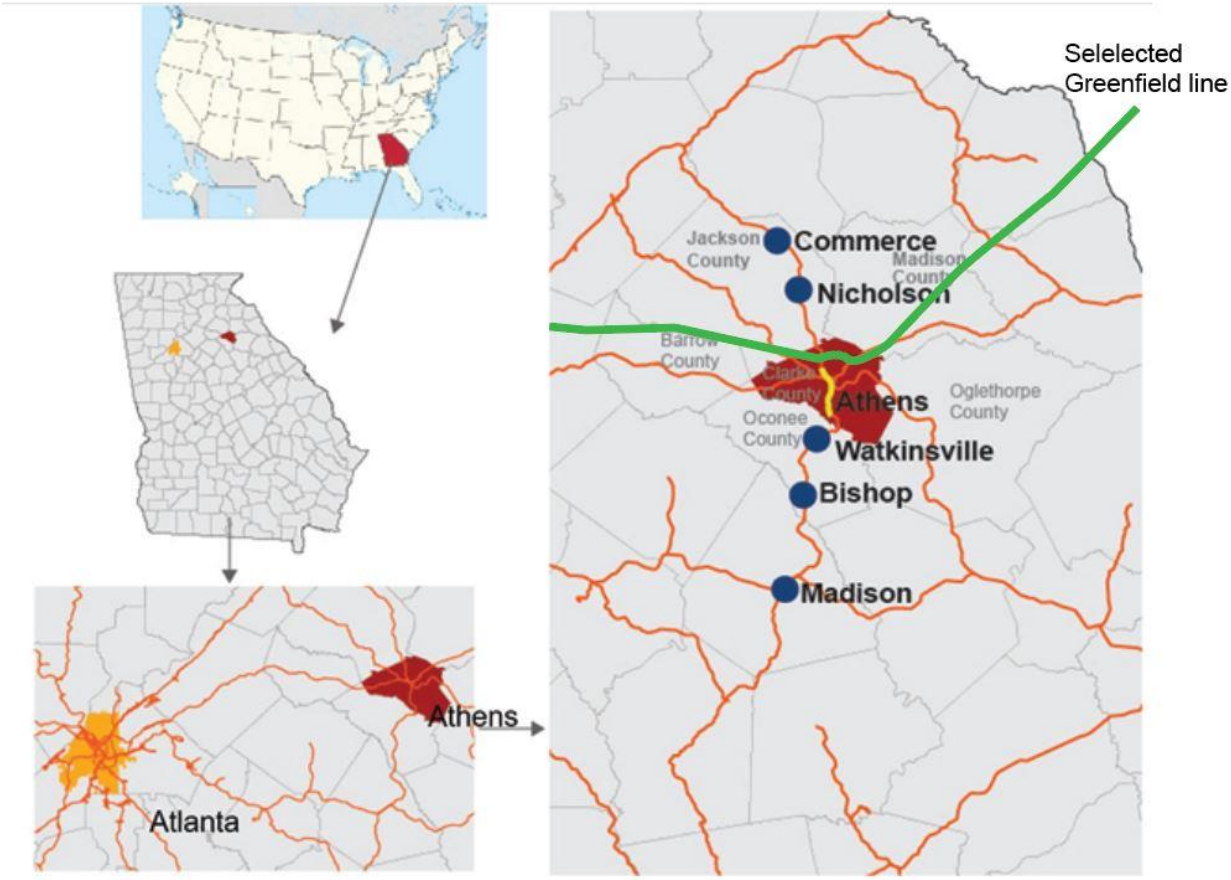


Figure 7: Context of railroads in the state of Georgia, the lines passing through Athens and the selected Greenfield line passing through Athens

This alignment is key to potentially linking these developments as well and the ability to use and develop it for multiple transportation types requires local control. Ideally, the N&S railroad segment should be purchased by the State Department of Transportation. Other ownership forms could include a shared purchase by the three counties and the university, purchase by short-line operator and long-term lease by local institutions or a long-term lease with N&S for the use of the right of way. In any case, and with the value it assures the N&S, the alignment should always include at least one track that is capable of carrying freight (heavy rail). This is an economic development consideration that recognizes that the future freight tonnage will favor rail growth due to the effects of highway congestion and fuel costs on trucking. N&S

can be given freight use assurance as a future option. Gaining some form of long-range control over the alignment is absolutely key to the possibilities that are discussed herein and it simply facilitates development decision-making, timing and economics.

This research will look at a segment which is a part of this larger 38-mile long line, which passes through Athens before providing a connection to the chosen Greenfield line. It is an approximately 5.5 miles segment between the Standard residential complex on North Avenue, to the southern end of Milledge Avenue (where it meets Whitehall Road), in Athens. A majority of this rail line passes through the UGA campus (UGA is the landowner). The university has purchased the rail right-of-way along the entire length of campus and the City-County government of Athens-Clarke owns land adjacent to the balance of the case study corridor.

Summary of facts about the 5.5-mile long rail line:

- The built-up part of the main UGA campus is a little over a mile area. With students, faculty, staff, educationally related research workers as well as visitors, there are about 45,000 to 50,000 people in this square mile, who are captive passengers.
- The existing bus system is stretched thin with 11 million passengers annually and the university leadership has quoted that getting around campus has become more challenging.
- As noted before, it is important that a good local transit system to pick-up and drop off passengers should be in place before an intercity commuter line is opened.
- Unless Athens and UGA set up a rail line, the other counties will not take an initiative because their densities are nowhere close to what UGA provides and hence they

cannot be the first ones to justify rail. For the rail to become a regional success in the future, it has to first set an example by building on the captive ridership that justifies a campus rail system.

- With the implementation of the first phase of rail transit, which has to include the trains and maintenance facilities, it becomes easier and more cost effective to add on to the system and connect to other destinations, regionally.
- There is an intangible value in providing more commuting options with the university informing transportation planning within its boundaries and hoping the strategies will be emulated regionally.

In summary, it can be seen that the town of Athens has an existing bus system (university and city) and an unused rail line through the UGA campus. In the next chapter, the author will describe the purpose of the case study research and all the four case studies in detail, including the evaluative criteria that are developed from them.

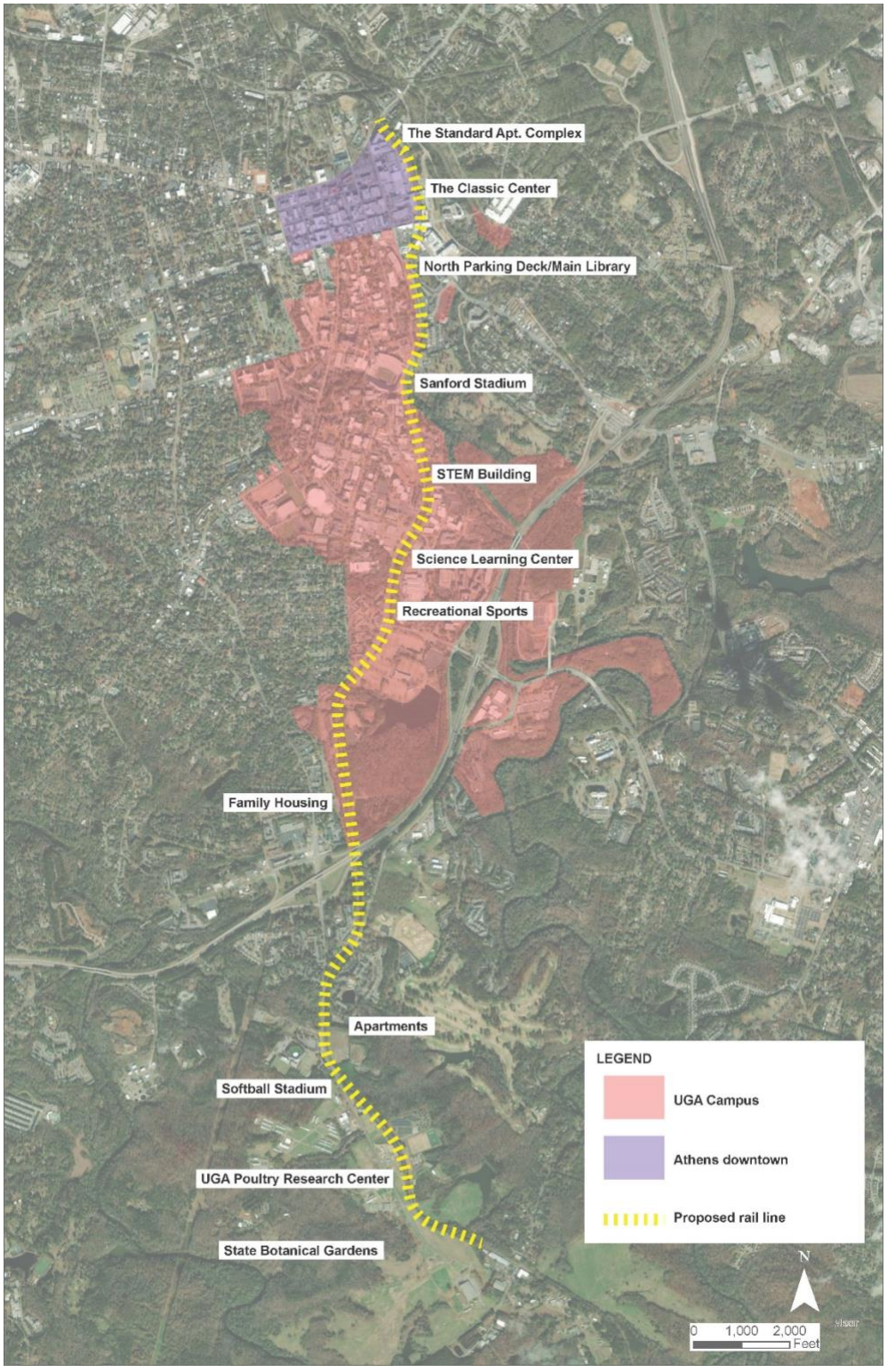


Figure 8: The unused rail line passing through the UGA campus and some of the main landmarks alongside the rail (these are not potential stations. Map with rail stations is added later in this document)

CHAPTER 4

METHODOLOGY

The research uses a qualitative design approach to answer the research questions. A qualitative research approach provided rich descriptions to assist with this complex research topic. Since the topic of institutions launching rail transit systems is under-explored, a qualitative research approach was helpful to define and articulate the research analysis. In order to answer the research questions, this research approach helped distill the complexity of the research into manageable parts. Understanding the success and shortcomings of rail systems in urban systems assisted in understanding their applications and workability within an institutional context.

This research uses the case study approach to answer the research questions and sub-questions listed in the introduction. There are two tiers of case studies conducted:

- Four city-level case studies to determine evaluative criteria and their thresholds
- One institutional case study where the criteria and their thresholds will be applied

The purpose of the case studies is to determine the factors that contributed to the launching of rail transit systems in urban settings. Moreover, interviews with transit officials from the selected cities assisted greatly in defining the contributions of this research in order to make it translatable to other institutions.

"The essence of a case study, the central tendency among all types of case study, is that it tries to illuminate a decision or set of decisions: why they were taken, how they were implemented, and with what result." (Yin 2009)

The main reason for adopting this methodology is to develop criteria that are uniform across the realm of rail transit planning in terms of the initiation of the system. The case studies will help inform these criteria from an urban context, which will then be applied to the institutional context for this research.

4.1. Research Design

The author selected the following case studies for the first tier of the case study research. These case studies will be responsible for the development of the evaluative criteria that are the basis of any rail transit project initiation.

- Charlotte, North Carolina (transportation agency: Charlotte Area Transportation System)
- Denver, Colorado (transportation agency: Regional Transportation District)
- Minneapolis-St. Paul, Minnesota
- Portland, Oregon (transportation agency: TriMet)

The four cities selected for the first part (tier) of case studies were carefully picked because they satisfied a common set of conditions:

- All of them are newer rail transit projects
- All the cities started with a single rail line (single-line systems)

- All the rail systems have now expanded to become larger, regional transportation systems because of their initial successes.

The author identified transportation officials in all four cities and contacted them. Thereafter, meeting dates and times were secured to meet virtually or in-person to discuss the details about getting rail transit started in their respective cities. Permissions were also secured for the interviews to be recorded in some cases. Following is the list of six questions the author used as a guide while interviewing the transit officials in each city:

1. Can you briefly discuss the history of rail transit in the city?
2. What are the factors that made the transportation agency prioritize rail over other modes of transportation? (motivating factors)
3. What were some of the obstacles the agency faced during the initial rail transit decision-making?
4. What were some of the wins or important milestones once the agency decided to make the first rail line a priority?
5. What were your learnings from the implementation of that first rail line?
6. What would be your advice to an institution wanting to initiate rail transit through its campus?

The interviews were semi-structured in nature, where the author asked the main question and the interviewees were free to answer the question and also discuss more or provide additional information on other closely related topics according to their knowledge and experience. All the interviews provided valuable insights about transportation planning specific to rail in urban

settings. The criteria described in the next chapter are derived as a result of these enriching interviews. The contributions of this research are shaped by the data obtained from the qualitative method of conducting interviews.

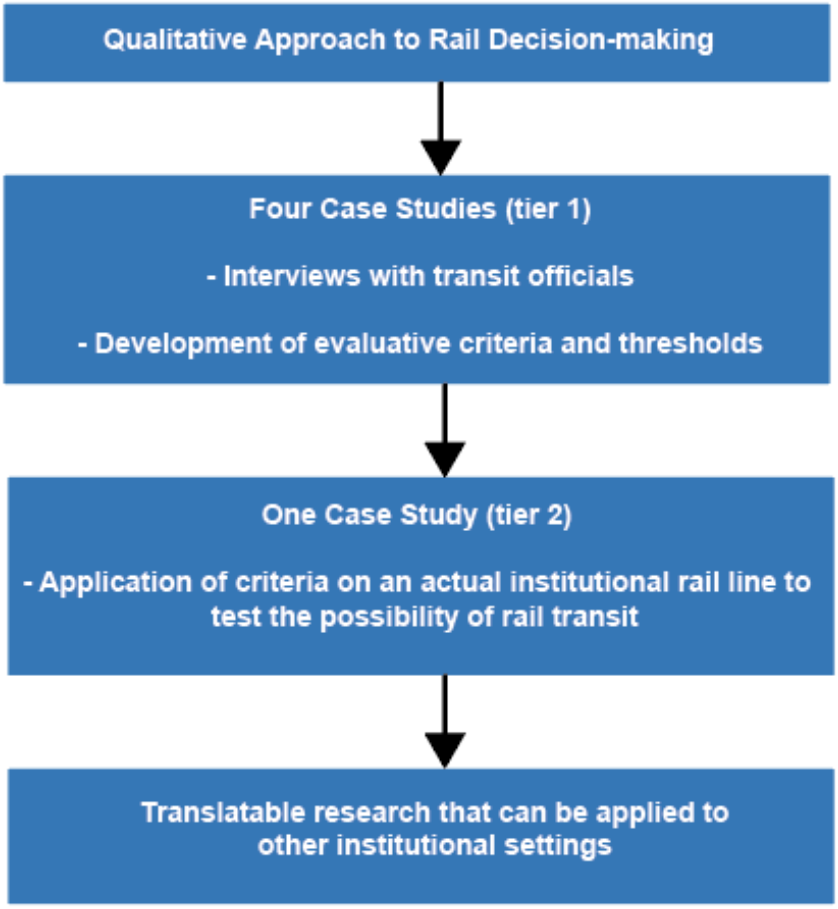


Figure 9: A diagram showing the research design

Once all the interviews were complete, the author transcribed them and found the criteria that made these transportation agencies prioritize rail planning and initiate the first steps for planning and decision-making. The thresholds established by the transit agencies for the first rail line are within an urban context and the author will test them on an institutional context for the University of Georgia.

In summary, the goal of the research design described above was to establish criteria that are derived from urban settings. These criteria were then applied to the institutional setting for the unused rail line passing through the University of Georgia. In the next chapter, the author will discuss each criteria in detail before applying it to an institutional context.

CHAPTER 5

CASE STUDIES AND DETERMINING CRITERIA

This chapter includes case studies of rail transportation from some cities in the United States. The goal of the author in this chapter is to study the various rail transportation systems in different cities and develop the common criteria from the studies to be applied to the rail transit study in Athens, Georgia, to test if an institution can substitute for standard urban ridership as a catalyst for passenger rail. The cities studied in this chapter are Charlotte (North Carolina), Denver (Colorado), Minneapolis-St. Paul (Minnesota) and Portland (Oregon). The information was provided by transit officials when interviewed by the author. All the data in this chapter is derived from the lengthy interviews conducted with the transit officials in each city.

Prior to describing the data from the interviews with transit officials, there are a couple assumptions central to this research. Firstly, this research takes into account urban areas that developed rail lines post the automobile boom. In the cities where rail existed before the automobile (New York City, Boston, etc.), the densification occurred along the railroads. People, services and infrastructure had to choose to establish themselves along the rail line, which increased density along the rail over time. In recent years, it is the other way around and the cities have to create the density before building the rail line in order to ensure rail transit's viability and compete with the convenience of automobile travel (that people and cities have gotten used to). In both cases (pre-car and post car) the rail line still attracts density. Secondly,

the author will not be comparing the exact types of land-uses from the urban context to those within an institutional context. It is the overall density that is vital to this research.

5.1. Cities Selected for Case Studies

5.1.1. Charlotte, North Carolina

It took 20 years for Charlotte's light rail line to become a success. During the 1980s, many top political leaders in North Carolina as well as the country recognized the need for rail transit. However, any suggestions for taxes to fund the rail needed the approval of the rural-dominated North Carolina State Legislature. Two major impediments had to be negotiated:

- Convincing a conservative electorate that rail transit was not a waste of time and resources
- Finding the funding to build it

Charlotte Trolley was a concept that came to fruition when a volunteer group of rail enthusiasts and developers decided to restore an antique trolley car (found being used as a rental home outside Charlotte) and run it on an unused railbed near downtown. In 1996, after eight years of fundraisers, Charlotte Trolley launched a 1.8-mile ride, drawing sizable crowds who appreciated the nostalgia of old-fashioned streetcar travel. Keen-eyed developers built rail-oriented mixed-use projects, anticipating that a light rail system would be operational in the future.

In 1996, six months into his first mayoral term, conservative Republican Pat McCrory made rail transit his top agenda. He lobbied relentlessly, not about carbon footprints or global

warming, but about transit as economic development. The legislature finally approved a half-cent sales tax for transit, if the voters approved it in 1998.

The final tally to build the 9.6-mile light rail line was $473 million: $107 million from state money, $213 million from federal funds, and the rest in local money (original estimates were $227 million). Additionally, Charlotte City Government spent $60 million for pedestrian and intersection improvements near transit stations, including a 3-mile sidewalk and bike path beside the railbed.

The county's half-cent transit tax mentioned above made up about half the transit agency's revenue. The Charlotte Area Transit System (CATS) built and began operating its first, 9.6-mile long light rail line in 2007 (LYNX Blue Line operates from I-485 at South Boulevard to Uptown Charlotte). The planning phase for light rail began in 1994 by developing an overarching growth model/framework titled *"Centers, Corridors and Wedges"*. Ten years after the Blue Line was put in place, it was extended in 2017 to the University of North Carolina's (UNC) Charlotte campus to serve the university community, add more passengers to the system and improve their access to downtown Charlotte. This is an example of an institution requesting an extension of a rail transit line through its campus.

As mentioned above, before the Blue Line was built, there was a 4-mile long trolley system that existed (on the same location where the Blue Line was built) in Charlotte. This trolley system enjoyed public support and had a good amount of political traction associated with it. Therefore, considering the popularity of the trolley system, CATS was asked to prepare a plan that incorporated light rail transit as a mode of public transportation in downtown Charlotte for the near future. This is when CATS developed their land use and growth framework mentioned

above. The main mission of this framework was to acquire, preserve and protect the rail corridor for a future light rail possibility (time period from planning to implementation 1994 to 2007). CATS has repeatedly indicated that corridor right of way acquisition is the single most financially challenging aspect of rail transit (largest cost is that of land acquisition).

In 1998, the County created the 2025 Transit-Land Use Plan and enacted the half-cent sales tax as a blueprint for investing in public transit projects to proactively address the potential growth challenges. The belief was that by integrating the rapid transit system with land-use planning along five strategic corridors, it would support economic growth in a way that encourages sustainable environments and travel behaviors, improves the quality of life and attracts businesses and people to the metro region. And thus, the 2030 Transit Corridor System Plan was born. CATS continues to update the 2030 Transit System Plan while implementing rapid transit project improvements. These investments increase access and mobility options through the expansion of transit services, enhancing customer amenities at stops, creating pedestrian-friendly neighborhoods in close proximity to light rail stations, and integrating transit-oriented development policies.

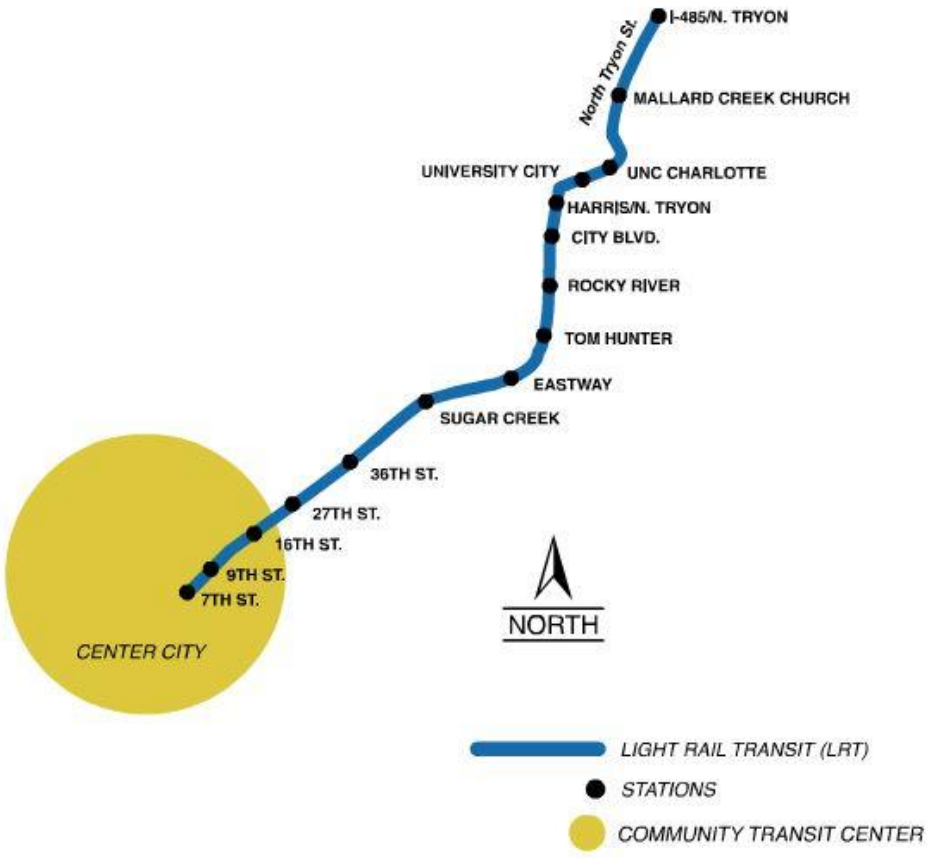


Figure 10: Map of the first line in Charlotte, provided by the Charlotte Area Transportation System (CATS)

As mentioned above, with light rail on the way after the 1998 passage of the transit sales tax referendum, the City of Charlotte adopted the South-end Transit Station Area Plan on June 13, 2005. This document was intended to provide a vision for the growth and redevelopment of the South End, particularly the areas around the district's three future light rail stations. Providing detailed recommendations for issues such as scale, density and design, along with the community's investment in fixed guideway transit, the groundwork was laid for the private sector to step in. By the time the fifteen-station light rail line that was built on the former freight railroad corridor and opened on November 24, 2007, transit-oriented development was already

well underway. In fact, between 2005-2009, Charlotte witnessed 9.8 million square feet of new development built along the 9.6-mile Blue Line, representing a total of $1.8 billion in private development.

It is also interesting to understand the shift made by CATS from including bus rapid transit and rail transit planning to focusing solely on rail transit planning. Until 2002, bus rapid transit (BRT) was a part of the CAT's land use and growth plan. However, by 2002, the public support for light rail had increased significantly. This led CATS to develop alternative analysis for rail and focus their complete attention on planning and implementing the light rail system and take BRT out of their long-range regional framework. Thus, currently, all the planning and implementation efforts are focused on light rail only. In terms of its light rail implementation CATS received the New Starts federal grant to help fund the initial 9-mile long rail corridor. The New Starts Program is a competitive federal grant program to support rail/fixed guideway systems (cities across the country compete against one another to receive these grants). The funding sources for the initial length are listed below.

- New Starts federal grant program (50%)
- State funds (25%)
- Local sales tax (25%)

As of the second quarter of 2016, the American Public Transportation Association (APTA) documented LYNX weekday ridership at 17,100, making Lynx the eighteenth largest light rail system in the United States in terms of ridership. The successful implementation of the LYNX Blue Line has resulted in additional transit infrastructure investments throughout the city. These include the opening of the CityLYNX Gold Line and a future extension of the LYNX Blue Line.

The Lynx Blue Line's extension to University of North Carolina (UNC), Charlotte is a more recent one, which began operation in 2018. According to CATS, it was a fairly easy extension as the transit agency received over half of the rail right-of-way from UNC (UNC provided the land it owned, so CATS did not have to worry about land acquisition for more than half of the extension line). CATS had reached out to UNC in the early 2000's to extend the Blue Line into UNC (to increase transit ridership for CATS), however, the university leadership declined the possibility at the time. However, the change in UNC leadership in subsequent years resulted in a more progressive set of decision-makers, who wanted to connect UNC Charlotte to downtown Charlotte and vice versa via light rail. This is exactly what fueled the Blue Line extension into the university in 2017.

The Blue Line Extension ties into the existing Blue Line light rail service, a 9.5-mile track that currently operates from uptown to south Charlotte. Four stations serve the university. North Tryon Street has stations at University City Boulevard, McCullough Drive and J. W. Clay Boulevard, with large parking decks at the J. W. Clay and University City locations.

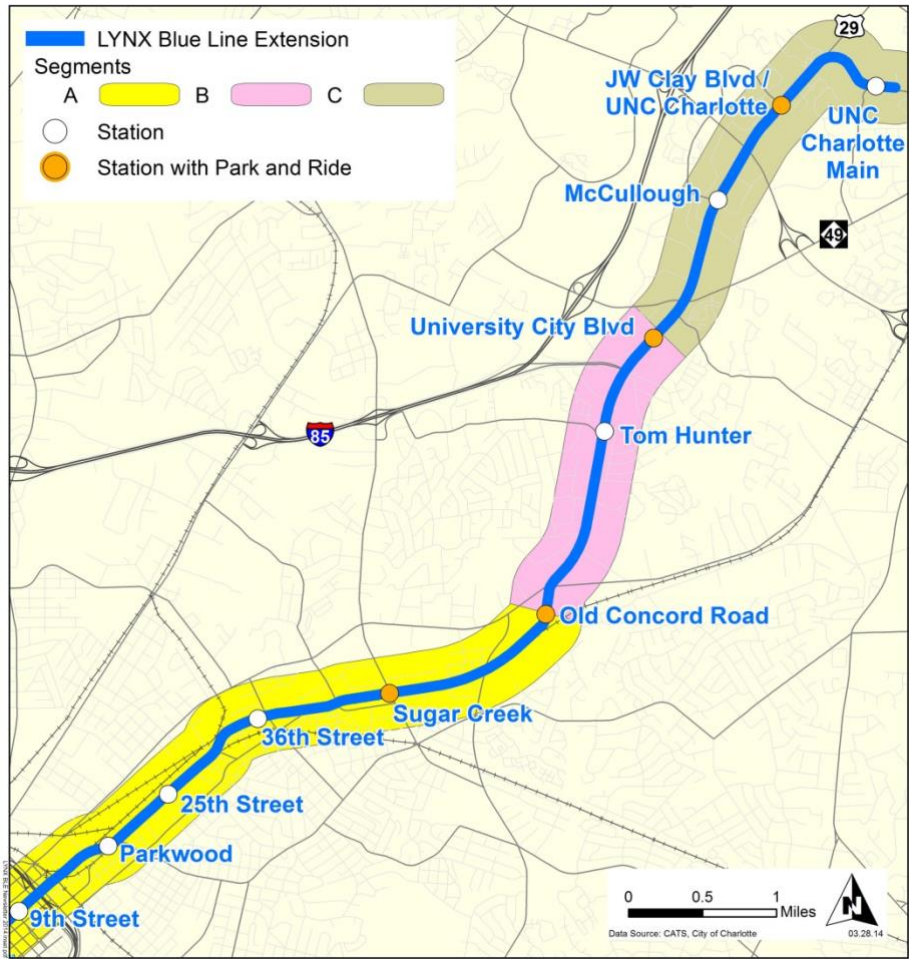


Figure 11: Map of the rail transit extension in 2017 to the University of North Carolina (UNC), provided by the Charlotte Area Transportation System (CATS)

The UNC rail line runs along an exclusive right-of-way and is projected to carry a daily ridership of 24,500 by 2035.The 9.3-mile extension adds 11 new stations to the Blue Line, bringing its total up to 26 stations on 18.9 miles of trackage. Four park-and-ride stations have been constructed as part of the line extension, providing approximately 3,000 spaces to reduce vehicular congestion of the I-85 highway. Further intermodal opportunities are planned with the integration of the CATS bus services from neighborhoods adjacent to the light rail stations. Funding for the $1.1 billion project came from the federal government providing half of the budget, with the city and state splitting the remainder.

In terms of the discounted student fare, UNC Charlotte students will have unlimited rides for $25 a semester, an agreement with CATS that could provide ridership and will give the transit system a windfall of $1.1 million. University students will have a mandatory $25 fee included in their bill each semester. In return, they have unlimited rides on light rail or Charlotte Area Transit System buses. Faculty can pay $75 annually for the same privilege. In 2017, CATS sold $27,000 worth of discounted passes to UNCC students and faculty. However, with 23,400 undergraduates now paying for the pass, CATS gets about $1.17 million in revenue (irrespective of whether or not the students will use the pass).

As for UNC, the easy connection via the UNC Charlotte Main Station and the Ninth Street Station in uptown will open even wider the door of opportunity to expand the undergraduate and graduate programs offered at the university's center city campus (the student enrollment is projected to be 35,000 by 2025).

It is extremely convenient to enroll in classes, earn a degree, attend a basketball or football game, and take in a theatrical performance or concert at the Robinson Hall. Likewise, the business and research communities now have greater direct access to both new and established opportunities to benefit from the university's role as convener in activities like energy summits and conversations about startups, technology transfer, and business-university partnerships. The light rail enables many students to access more internships and volunteer opportunities, and orientation counselors may use the train as part of orientation to introduce new students to the area.

In summary, the factors that initiated light rail and its expansion in Charlotte are:

- A solid land use management and growth plan for the region that has a strong vision (**in this case preserving and protecting rail corridors for the future**) focused on light rail
- Strong and consistent public and political support/commitment
- Focusing on just light rail implementation and rail-trail connectivity
- Land acquisition, sales tax and competitive funding
- Sustainable economic growth

5.1.2. Denver, Colorado

Denver, one of the fastest growing metropolitan regions in the United States, has recognized the significance of light rail transit (LRT) in providing an alternative to the automobile and in addressing the need for minimizing pollution and congestion in its burgeoning downtown area. Metropolitan Denver officials continue to support this mode of transportation and anticipate that future funding will be made available to enhance and complete the proposed regional rapid transit plan.

The rail transit system in Denver began its operation in 1994 along a 5.3-mile track. The two main reasons for this first length of track to be built and a rail transit to be initiated were history and politics favoring rail transit.

When the Regional Transportation District (RTD) was established by the Colorado state legislature in 1969, the agency's main mission was to establish personal rapid transit (PRT) in the core Denver metro area using rail. It was believed that rail would be a good alternative to

provide connectivity when Denver was about to host the Winter Olympics in 1976. However, the city voted against hosting the Winter Olympics and hence, lost federal dollars that would have funded the rail transit in downtown. PRTs have become increasingly obsolete in recent times given the rate at which our urban areas are densifying and therefore, in need of transit options that can carry a considerable number of passengers per trip.

Although planning for the metropolitan region's rapid transit system began in the early 1970s, it was not until 1987 that RTD was directed under Colorado Legislature House Bill 1249 to develop a plan for financing and implementing rapid transit within the seven proposed corridors and to submit that plan to the Colorado General Assembly. As a direct result of House Bill 1249, in 1987 the RTD Board of Directors also adopted the "Fastrack Program" and identified the preferred alignment, technology, and financing on each of seven corridors. In 1989 a Colorado state use tax ruling on appeal allowed RTD to collect a “use tax” on goods and services purchased outside the district for use within, thus providing a 100% local funding source for the central corridor. The corridor was selected by the RTD Board of Directors for a rapid transit demonstration line that would connect the Auraria Higher Education Center (a three-college campus with approximately 32,000 commuting students), the central business district (CBD), and Stapleton International Airport and would be funded entirely with local funds or the income generated from the use tax, which was a tax of 0.6% on metropolitan region retail sales. In 1990, light rail technology was selected by a community advisory committee and adopted by the RTD Board of Directors to be used in the northeast corridor. Originally, the alignment was to run from Auraria to the old Stapleton Airport. However, because of outcry from residents along Martin Luther King Boulevard near the airport who associated LRT with mile-long freight trains,

the line was shortened from Auraria to Downing Street. Thus, a sales tax was set up for the downtown area to fund the potential rail transit and RTD built a 5.3-mile long rail transit in downtown Denver as a trial project to see if rail transit was acceptable and workable for Denver. This first rail transit line eventually began operation in 1994.

RTD's light rail starter line was a conventional system running from a southern Denver terminus through the heart of the city and north to another terminus. As mentioned above, the line was 5.3 miles long and double track and cost $116.5 million to build. The southern half of the alignment is located in a former Denver and Rio Grande Railroad corridor with open ballast track, where the light rail vehicles reach speeds of 55 mph. The remaining track alignment is in Denver city streets with a maximum operating speed of 30 mph. Within the heart of the city, the alignment completes a loop that connects major east-west streets and Denver's famous 16th Street Mall for transit and pedestrians as well as the Civic Center and Market Street bus transfer stations. The downtown rail operation is within a curb-separated, restricted lane in a contraflow direction to automobile traffic.

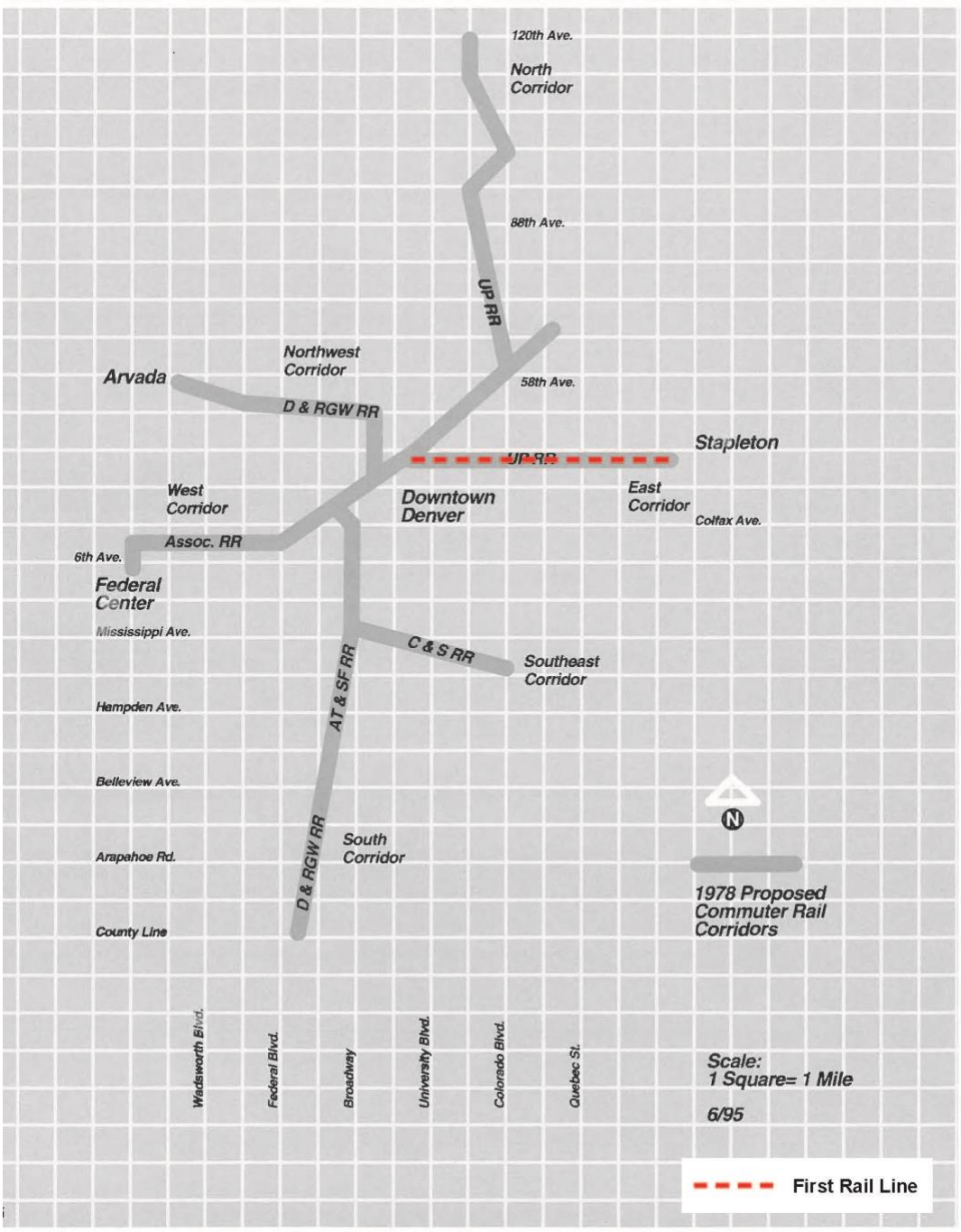


Figure 12: Map provided by the Regional Transportation District (RTD), Denver. The author has highlighted the first rail line on the map

The rail transit line was an instant success. This first rail line from the south of downtown to the east near Stapleton airport (old airport) was used as an economic development tool to develop land near the old airport and support diverse neighborhoods along the way. As for the thresholds, RTD underpredicted most of the transit criteria. It underpredicted the ridership numbers, the number of rail cars, as well as the parking requirements (undersized). The forecasted ridership was exceeded upon operation. Transferring passengers from buses eliminated nearly 530 bus trips from the downtown areas, a commitment given to the city of Denver and its residents as part of the advantages of rail transit.

Subsequently, the downtown began experiencing heavy development and investment (beginnings of transit-oriented development). The other regions therefore, saw the merits of a rail transit corridor through them and began demanding for rail transit as well. As a response to the increased demand for rail transit, RTD prepared the FastTracks Plan in 2004, asking for an increase in the sales tax to build more rail, regionally. Today, RTD plans for, and implements rail transit expansions on a regional scale, while dealing with multiple jurisdictions (8-county region).

The first 5.3 miles of rail transit in downtown Denver was built because historically, building rail was a part of RTD's initial legislative mission upon establishment. Politically, the sales tax base was also tied to rail transit and also on the premise that RTD would build rail in the downtown core. Thus, strong historical and political perspectives along with overwhelming public support were responsible for the initiation of rail transit in the city of Denver.

Lessons learned by RTD post the implementation of the first rail transit line

During the 1980s light rail projects were at a distinct disadvantage since most surface trolley systems were discontinued in the 1950s. The technology had changed, and experienced rail transit personnel were retired and lost to the industry, so a new generation of transit professionals had to be developed in order to accommodate the resurgence of rail projects. After nearly two decades of development, Denver was able to take advantage of new technology and these new-generation transit professionals.

As part of the planning phase, it was decided that off-the-shelf technology would be implemented whenever possible. Furthermore, the design criteria would require the system to be simple and yet expandable. The central corridor project was the starter line for the region, and it was important for providing citizens an opportunity to become familiar with the efficiencies inherent in rail operations.

A relatively small design and construction staff team was organized to manage consultants in the design and construction of the project. The team was composed of transportation planners, engineers, and project managers with previous experience in light rail design, civil construction, community relations, and light rail operations personnel. In the design and construction process, RTD evaluated every element of the light rail system to ensure that future construction would benefit from the project. The elements specifically addressed were the installation and maintenance for drainage, duct banks, utilities, street pavement treatments, station design and consistency, adjacent facilities, electrification, signalization, and track appurtenances. In general, RTD attempted to balance the existing project demands with future

expansion and do so within a budget supported entirely by local funds. Lessons learned from other projects prompted many of these considerations.

Milestones leading up to the operation of the first rail line in Denver:

- 1969 → RTD was established with a budget of $170K for its first year.
- 1972 → RTD completed its first transportation plan for metropolitan Denver.
- 1974 → RTD consolidated and the Denver Tramway Company (by then Denver Metro Transit) sold to RTD. Eventually RTD acquired all the smaller transit companies in the area. RTD therefore, simplified transit between areas in metro Denver, extended routes and lowered fares.
- 1975 → RTD rebranded itself and called its services "The Ride"
- 1982 → 16th Street Mall opens (free mall ride bus stopping at every block)
- 1994 → The first rail transit line begins operation

Sustained Commitment to Rail Transit

Twenty-five years after the operation of the first rail line, RTD now operates eight light rail lines and three commuter rail lines in Denver. RTD has ensured a continuous commitment to rail transit development by putting together the FasTracks plan. FasTracks is a comprehensive twelve-year plan designed to implement transit services and facilities in the Denver metropolitan region. FasTracks officially was born in 2004, when Denver-area voters approved a sales tax (0.4%) to help pay for one of the largest transit expansions in the nation. Since then, Denver has undergone a transportation transformation, with rail and BRT corridors extending for miles in all directions across the metro area.

With the FasTracks emphasis on regional land use development, transit-oriented development (TOD) has become a major focus within the entire Denver region. The City and County of Denver, the Denver Regional Council of Governments (DRCOG), and the Denver Regional Transportation District (RTD) now all have TOD programs. The Metro Denver Economic Development Corporation has a TOD focus, and TOD plans are being created at all different scales from individual station areas to the entire region. The City and County of Denver has even developed its own TOD typology that separates its rapid transit stations into seven individual TOD station types, recognizing the important differences between different places and destinations within the region.

In Denver, the CollegePass program gave the transit system $13.9 million in 2017. That's nearly 10 percent of Denver's total fare revenue of $141.2 million.

5.1.3. Minneapolis-St. Paul (Twin Cities), Minnesota

When the Twin Cities Metropolitan Transit Commission (MTC) was created in 1967, the prevailing vision for rail transit was "heavy rail", completely grade separated subway and elevated trains. Although historically the model under consideration was the New York Subway or the Chicago "L" elevated system, new systems under design in the San Francisco Bay Area and Washington DC were updating the concept with computer-controlled trains and a higher level of passenger amenities.

The discussion of rail transit began in earnest after the purchase of the privately-owned Twin City Rapid Transit bus system in 1970. MTC wanted to build rail and began making plans accordingly. However, the Metropolitan Council opposed heavy rail, arguing that the Twin

Cities lacked the density to support it. Thus, began a battle for control of long-range transit decision-making. All through the 1970s the Council and MTC were at loggerheads with the rail project at a standstill. Numerous studies were undertaken, none resulting in any construction.

During the 1970s rail planning was temporarily diverted by the introduction of automated people movers. Although they would become a staple of airports and other short distance applications with simple route structures, proponents foresaw something much more ambitious in them. Everyone was watching a demonstration project in Morgantown, West Virginia, where small, automated vehicles could be programmed to go directly from one station to another without intermediate stops, and there were routing options.

In the Twin Cities the concept was dubbed Personal Rapid Transit, or PRT, and was promoted with much enthusiasm by a University of Minnesota engineering professor, J. Edward Anderson. He argued for small four-person vehicles on elevated guideways that would largely duplicate the arterial street system. The vehicles would choose the most direct path through the network and the conventional stop-and-start rail transit would become obsolete. A small local test track was even built. None of the research about PRTs materialized, rather it further stalled rail transit decision-making.

Following suit, the City of Saint Paul competed for and won a federal grant for a Downtown People Mover, roughly one mile of elevated guideway from downtown to the State Capitol. Anticipating the people mover, the Town Square development at 7th and Cedar Street was built with a diagonal slot between its two towers for a people mover station. A local referendum put a stop to this project in 1980.

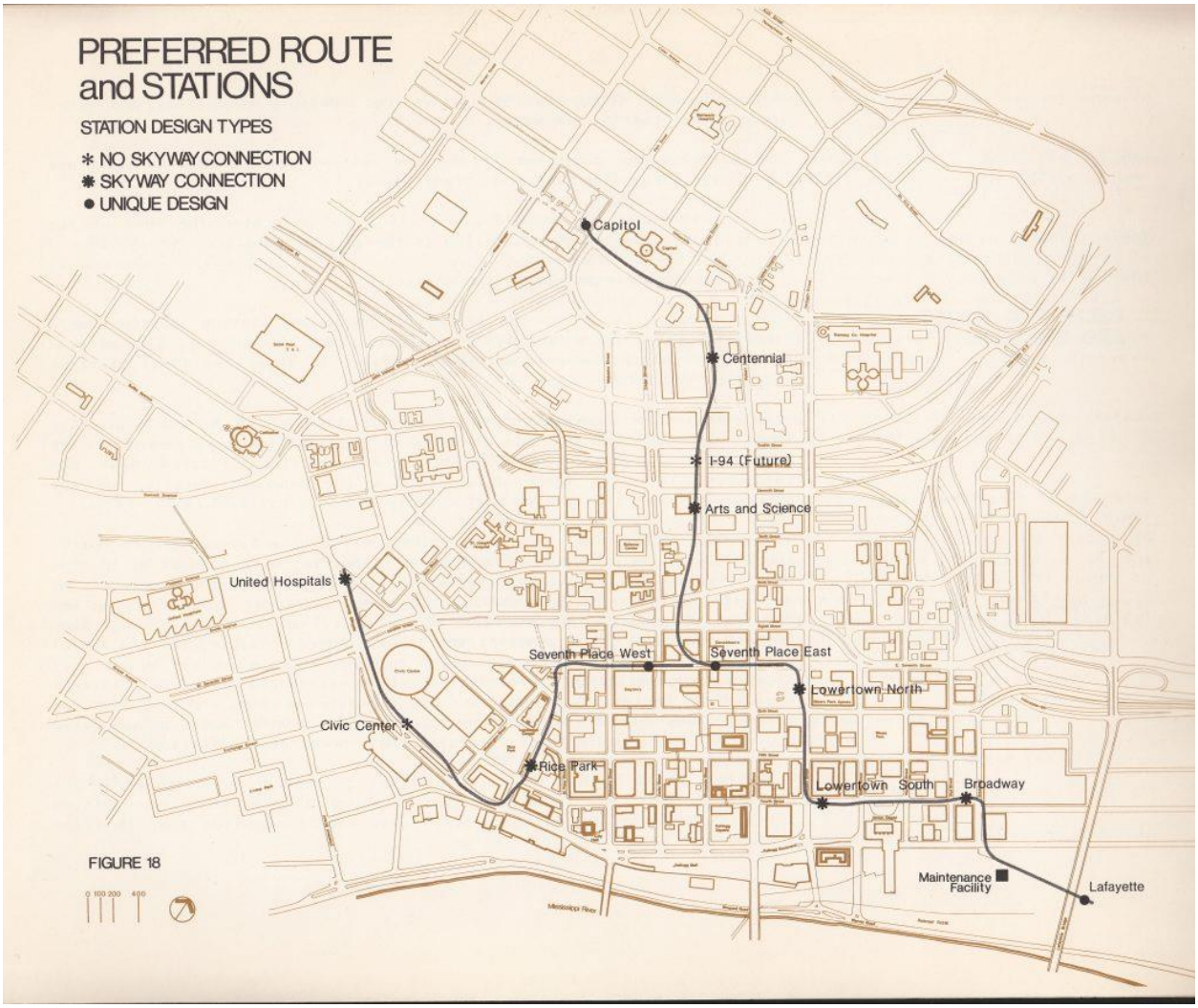


Figure 13: Downtown people mover map provided by Metro Transit (this project never materialized)

The MTC proposed doing a light rail transit study in 1979, but the Metropolitan Council prevented it. That same year the City of Minneapolis and Minnesota Department of Transportation jointly studied light rail in the Hiawatha Corridor, where citizen opposition had recently stopped a freeway from being built.

Over the Metropolitan Council's objections, the state legislature in 1980 directed them to study light rail. When the study was completed two years later, the Metropolitan Council

changed its regional policy plan to remove the prohibition on fixed-guideway transit. Meanwhile, Calgary and San Diego had opened light rail lines. Clearly a shift was underway, which was being tracked in the Twin Cities.

The ongoing feud between MTC and the Metropolitan Council landed in the state legislature's hands, and in 1984, the legislature created a third agency, the Regional Transit Board, as a buffer between the former two. Moreover, in 1985, a law was passed banning any expenditure of public funds on light rail. Once again, the legislature reversed itself and removed the LRT ban in 1987. By then Buffalo, Portland and San Jose rail transit systems had opened.

This time around, the legislature created the tool that would eventually get light rail funded through the county rail authorities. The 70s and 80s saw the abandonment of most of the state's rural railroad branch lines and the rail authorities were the mechanism created to rail bank them. What no one foresaw was that the Twin Cities metro area counties would preserve abandoned rights of way for light rail, for the future.

The rail authorities began doing light rail studies on their own, and the legislature directed the Regional Transit Board (RTB) to do the same. Now there were too many agencies involved, so the legislature created a Light Rail Joint Powers Board in an attempt at coordination.

In 1994 the RTB expired and this service meltdown caused the legislature to abolish the RTB in 1995 and shift its powers to the Metropolitan Council. In the process it folded MTC into the Council as well. Meanwhile, light rail transit lines opened in Los Angeles, Baltimore, St. Louis and Denver.

In the 1990s, it seemed light rail in the Twin Cities was going nowhere due to the lack of political consensus and funding. Doing an end run around the Met Council, Hennepin County Commissioner and Rail Authority chairman Peter McLaughlin and Congressman Martin Sabo secured federal and local funding for a Hiawatha light rail line in 1998. The first of the Twin Cities' modern light rail lines was built between downtown Minneapolis and the suburb of Bloomington. The line connects Target Field downtown to the International Airport and the Mall of America and was intended to help ease congestion along Highway 55 and the balance of the Hiawatha corridor.

The total cost to design and construct the Hiawatha Line eventually was $715.3 million, with the largest share of funds ($424 million) coming from federal appropriations and grants. The Minnesota Legislature contributed $100 million; the Metropolitan Airports Commission, $87 million; Hennepin County, $84.2 million; and the Minnesota Department of Transportation, $20.1 million.

Figure 14: Map of the Hiawatha rail line provided by Metro Transit

The success design and operation of the Hiawatha line can be attributed to the following factors:

- Making light rail transit part of the total development program. Implementing the Hiawatha corridor plan included a land use development plan and agreement on appropriate public policies to carry out the program as well as the transportation alternative. Without them, the proposal to build LRT would not have been acceptable.
- Building a broad constituent base. Community support is needed to resolve the transportation issues in the corridor. Residents of the concerned neighborhoods, local businesses, labor, the downtown business community, and elected officials must be convinced of the value of the alternative selected.
- Let neighborhood representatives present the plan. Neighborhood representatives make effective advocates. They can illustrate community understanding of the issues and justify their recommendations.
- Presenting the rail plan when the right external conditions exist versus rushing with it. The Hiawatha line gained political acceptance and traction when the transportation problems had been around for "too long" and a part of Minneapolis was ready for significant redevelopment, jobs and housing (which are very important issues for transportation growth as well).

5.1.4. Portland, Oregon

The TriMet or the Tri-county Metropolitan Transportation District, founded in 1969 is responsible for the planning and execution of transportation projects and infrastructure in the

Portland Metropolitan area. TriMet has been profoundly influential in shaping the growth and character of the Portland region. Through innovations in policy development, system design and technological advancement, the agency continues to set benchmarks for the transit industry nationwide. Focusing specifically on rail transit, MAX (Metropolitan Area Express) is TriMet's light rail system serving the Portland metropolitan area. Presently, the five MAX lines (Blue, Green, Orange, Red and Yellow) run on 60 miles of track and serve 97 stations.

The central city and surrounding town centers in Portland provide vibrant options for a diversity of lifestyles. They are interconnected with efficient and accessible public transit services. Perhaps the most significant factor contributing to this turnaround was the vision advanced by regional leaders who understood and insisted on planning transportation and land use in sync. Decisions made during the 1960s and 1970s set the course for Portland to find itself highly rated on many "best places" lists. Important milestones include:

- A decision to cancel freeways that would have destroyed Portland neighborhoods, leading to state and local support for MAX, the regional light rail service that now links suburban communities from one end of the region to the other.
- Creation of public institutions that continue to collaborate and foster community engagement and public/private and city/suburban consensus.
- Establishment of TriMet, a public regional transit agency with new buses, a 12-block-long downtown transit mall and regional transit facilities.

The MAX light rail system was first operated in 1986 and was conceived as a result of revolts against the freeways that took place in Portland in the early 1970s. At the height of local freeway revolts in the 1970s, studies for mass transit began using funds made available by the

passage of the Federal-Aid Highway Act of 1973. These funds had been intended for the Mount Hood Freeway and Interstate 505 projects, but were abandoned amid strong opposition from the Portland city government and neighborhood associations. In 1973, the then governor Tom McCall assembled a task force to help research and determine alternative transportation options for the Portland metropolitan area. Local jurisdictions originally favored the busway alternative but support for light rail prevailed following the mode's inclusion in a 1977 environmental impact statement. The proposal became known as the Banfield light rail project (named after the Banfield Freeway, a segment of I-84 that part of the alignment followed). Post the approval of the project in 1978, the first train service was operational in 1986 for a 15.3-mile long stretch.

The Banfield light rail (now MAX) opened on a 15.3-mile alignment between the eastern suburb of Gresham and downtown Portland. It was the first rail service in the Portland region since the 1950s. The $214 million project was completed $10 million under budget. This new MAX line was very well received by the community and civic leaders and planners embraced its potential for guiding regional development and alleviating road congestion. It was understood and accepted that other light rail corridors would follow the Banfield line, but planning for those lines languished as TriMet recovered from its financial crisis and learned how to operate its first light rail line. In 1994, eight years after the opening of the Banfield line, Earl Blumenauer, then a City of Portland commissioner, sought to build on the region’s enthusiasm for light rail that had blossomed upon opening of the Banfield MAX line. He envisioned a series of regional rail summits to engage the public in a conversation about a sustained Portland rail transit program with coordinated livable communities.

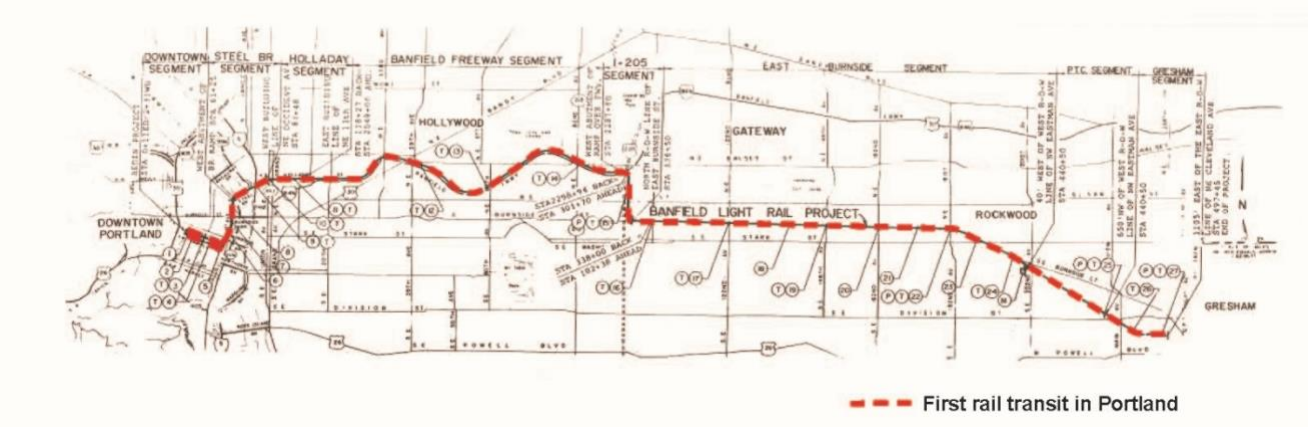


Figure 15: Map of the Banfield rail line provided by TriMet. The author has highlighted the rail line in red.

Sustained Initiatives to Support Fixed Guideway Transit

In 1986 the Ride Connection organization was created to supplement TriMet's door-to-door LIFT program. Two years later, Ride Connection became a nonprofit, working with community partners to provide and coordinate transportation options, primarily for older adults and people with disabilities. Ride Connection hosts a menu of programs in concert with other social service programs, including:

- The Ridewise program that teaches individuals with modest mobility challenges how to use the fixed-route transit system.
- Door-to-door services, which are supported by Ride Together, Ride About Shuttles, ride-upon-request and shared-vehicle programs.

Other tips for using fixed-route transit are provided through travel options counseling, riders' clubs and fare relief programs.

By 1990, TriMet and its transit services were getting positive national notice, often in conjunction with coordinated land-use planning. At the same time, TriMet worked closely with

partner agencies to integrate transit service into new developments and to bolster land-use plans around regional centers and corridors.

Recognizing how the real estate market responds to transit investment, Portland's 1972 Downtown Plan and 1988 Central City Plan relied heavily on investment in the Portland Transit Mall, light rail and the streetcar loop to catalyze revitalization and minimize traffic growth. In the early 1990s, Metro and the rest of the region got on board by examining alternative ways to "grow up or grow out" through the landmark 2040 Growth Concept. Theory was put into practice when the alignment for the MAX Blue Line between Beaverton and Hillsboro was selected to follow an abandoned railroad corridor through the vast area of vacant land in order to shape new development around transit rather than try to reshape the auto-oriented development pattern along the Sunset Highway and Tualatin Valley Highway. Planning for each subsequent expansion of the MAX system reinforced the principle by making the development potential of alternative station locations a development decision, not just a mobility decision.

The Portland region has tailored each capital project and funding plan to particular opportunities and priorities. Funding mechanisms have included federal grants, state and regional flexible highway funds, urban renewal tax increments, general obligation bonds, local improvement districts, state lottery funds and public/private partnerships—with contributions from TriMet's general fund as well.

Milestones in TriMet Rail History

- 1969 → The Portland City Council passed a resolution to create TriMet under authority granted by the Oregon State Legislature. Operations of Rose City Transit were turned over to TriMet.

- 1970's → Portland community leader and light rail advocate, Dr. Lawrence Griffith, led the effort to bring back historic trolleys to Portland.
- 1975 → TriMet began operating Fareless Square in 1975, two years before the opening of the Downtown Transit Mall, as an integral part of our overall strategy to increase transit use and to help preserve the region's livability.
- 1977 → December 17 saw the opening of the Downtown Transit Mall which some believed triggered tens of millions of dollars in new downtown construction and solidified it as a retailing center.
- 1978 → TriMet's efforts to bring light rail to Portland included a Landmarks Commission approval of light rail operation with mandated mitigation of light rail impact through operation of vintage trolleys through downtown historic districts.
- 1986 → MAX Light Rail commenced operation to Gresham, renewing rail passenger service in Portland. A two-million-dollar grant was announced from the Urban Mass Transit Administration that enabled purchase of vintage trolleys.
- 1987 → Vintage Trolley Inc. was formed to assure operation of the Vintage Trolley system. A Local Community Improvement District was formed to finance the local share of the federal grant.

5.2. Determining Evaluative Criteria for Rail Transit

Based on the case studies above and through interviews with transit officials from the four cities selected for this study, there was a clear consensus on the criteria considered by the transit agencies in all four cities which helped them decide whether the rail transit was a feasible option for their metropolitan region. Following are the criteria established from the case studies:

5.2.1. Political Framework

- Transit advocacy and political will

5.2.2. System Planning

- Initial length of the rail upon operation
- Main ridership generators and density along the proposed line
- Station locations and surrounding land uses (current and future)
- Other multimodal connections to rail stations (more options and connectivity)

5.2.3. Finance

- Overall funding structure
- Cost of rail per mile
- Transit fare structure
- Operation and maintenance

5.2.1. Political Framework

- **Transit Advocacy and Political Will**

For the better part of a century, US transportation policy has overwhelmingly prioritized and subsidized private automobiles over transit and walking. Highways, wide roads, and parking dominate the urban landscape and are major features even in the most transit-friendly American cities. Lavishing financial and spatial resources on automotive travel has hollowed out cities and deprived bus and train systems, rendering fast, frequent, and reliable transit all too scarce. Prioritizing the expansion and maintenance of highway connections between downtown job centers and typically wealthier, whiter suburban areas has limited mobility and opportunity for

people of color and people with low incomes. The vast majority of streets in America are dangerous for walking, biking, and other forms of active transportation. We are left with a transportation system that exacerbates inequality, exacts a huge injury and fatality toll, squanders incalculable time lost to congestion, and presents an obstacle to environmental sustainability.

To reverse the entrenched policy bias against transit and win lasting change, American cities need strong leadership from their elected officials, an enterprising transit agency staff who are able to take risks and committed and sustained grassroots advocacy. In a variety of ways, civic groups across the country are pushing city leaders and transit agencies to make walking, public transit, and cycling work for people.

The data from the case studies will show that changing a city's transportation system is more successful and sustained when civic support for new approaches is strong. We believe the surest way to achieve transit policy reform is through smart, energetic advocacy— from transit advocates, business groups, unions, universities, and the full array of groups with a stake in affordable transportation options. Additionally, advocates outside government are successful when they push for ambitious, long-term change while simultaneously identifying immediate, incremental improvements. Advocacy organizations and transit agencies are most effective when they mobilize behind attainable goals while communicating clearly how early gains can lead to more ambitious visions for transportation systems and cities.

A part of the transit advocacy also includes inclusion of rail transit planning in comprehensive plans. If rail transit has to become a reality and a part of the collective

community vision, it has to be included through visual representations in future planning to increase its visibility.

5.2.2. System Planning

- **Initial Length of the Rail Upon Operation**

The four case studies will be used to understand the deciding factors behind the initial length of the rail for those cities. Different cities have specific goals behind deciding the initial length of the rail and measuring the success/failure of that first line is directly related to the physical length of the rail and station locations. This initial length of the rail, in many ways decides the future of the line itself and the researcher will use the case studies to relate the physical lengths of those rail lines to that in Athens.

- **Main Ridership Generators and Density**

The premise of this research rests on the fact that institutions have captive ridership that can be used by the mode(s) of transit passing through them. Therefore, in this case study, the University of Georgia is the main ridership generator. Some of the case studies also use institutions as their ridership generators and this section will take a look at the same by listing all the core generators. Universities and similar institutions are considered “special generators' ' of transit ridership depending on their size and capability to add a certain number of steady riders to the system. Transit can achieve greater ridership and cost-effectiveness by serving areas with higher densities and other complementary elements, such as mixed uses, pedestrian connectivity, and supportive parking management. While the scale and mix of uses may vary, all types of station areas have a role to play in boosting demand for transit trips to and from nearby land

uses. Where transit service is provided along a corridor with moderate to high frequency throughout the day, activities and land uses that generate all-day trip making, during both peak and non-peak hours, are highly desirable from the standpoint of transit efficiency. Institutional uses fall into several main categories. Educational institutions, in particular colleges, universities, and other post-secondary institutions generate significant demand for transit on the part of students and staff. Large research and region-serving hospitals can also benefit locations near transit, generating trips throughout the day by staff and patients. Finally, civic and cultural institutions, such as libraries, community centers, museums, and city halls attract significant travel by a variety of modes, including transit.

- **Station Locations and Surrounding Land Uses**

Here, the case studies will be used to study station locations of the core ridership generators along with the transit-oriented development around them. This research will then be applied to Athens and the potential station locations through UGA's campus (which are core generators of ridership on campus).

- **Multimodal Activity**

Multimodal access to public transportation considers and accommodates the many ways public transportation users get to and from a public transportation stop or center to access a public transportation service. Those methods include walking, bicycling, riding feeder public transportation systems (e.g., taking the bus to connect to commuter rail at a station), and driving. The idea is that providing the infrastructure and support services for multiple modes to public transportation will increase use of the public transportation system. Multimodal stations/hubs are

also very equitable as they provide transportation options for all users, including non-drivers such as the elderly, adolescents, the disabled, and the transit dependent. The researcher will analyze the integration of systems that help the station function as a multimodal hub using case studies.

5.2.3. Finance

- **Overall funding structure**

  Using the case studies to give a breakdown of the entire funding structure of the initial rail line (breakdown of federal, state and local funding streams).

- **Cost of Rail Per Mile**

  The cost of rail per mile usually involves multiple factors that are important to the transit agency for rail planning. These costs vary for every transit agency depending on their transportation, system and comprehensive planning priorities.

- **Transit fare structure**

  Without high-level goals to direct fare policy and pricing, fare structures have become more confusing and economically regressive — often at odds with transit's mission to provide convenient, affordable service. By taking a step back and defining goals to guide fare policy, agencies can provide a framework for making more deliberate decisions and balance the need to generate revenue from fares against other objectives. Each of the four case studies have unique fare structures. In fact, UGA has a fare collection system in

place for its on campus bus transit. In the next chapter, the researcher will use the case studies to suggest a fare structure for UGA-Athens inclusive of bus and rail transit.

- **Operation and Maintenance**

  Using the case studies, the researcher will provide an overview of the operation and maintenance considerations for the rail line in UGA-Athens.

In summary, it can be seen that there are a specific set of criteria followed by transit agencies to choose rail as their transit option. In all the four cities, there are multiple decision-makers at multiple levels (local, state, federal, private entities, etc.) for starting/launching the rail transit systems. However, institutions operate differently in that respect because they have a single decision-maker. This decision-maker could be a person or board that gets to decide how to best serve the campus through transit. All the decisions about densification and transit development and planning are the responsibility of this single decision-making body of the institution.

CHAPTER 6

ANALYSIS OF THE ESTABLISHED CRITERIA

This chapter will elaborate further on the findings from all the four case studies (described in the previous chapter). After meeting with transit officials from Charlotte, Denver, Minneapolis-St. Paul and Portland, the author was able to find specific commonalities that enabled these urban areas to choose rail transit as the primary mode of transportation (buses as secondary, feeding the rail systems). These criteria are evaluative and will be explained in this chapter and for some of them, the researcher will point out the ways in which they were handled by each of the four cities. Included with this chapter is a spreadsheet that summarizes the information of these evaluative criteria for the case studies. Following are the evaluative criteria for initiating rail transit:

6.1. Political Framework

6.1.1. Transit advocacy and political will

6.2. System Planning

6.2.1. Initial length of the rail upon operation

6.2.2. Main ridership generators and density along the proposed line

6.2.3. Station locations and surrounding land uses (current and future)

6.2.4. Other multimodal connections to rail stations (more options and connectivity)

6.2.5. Ridership

6.3. Finance

6.3.1. Overall funding structure

6.3.2. Cost of rail per mile

6.3.3. Transit fare structure

6.3.4. Operation and maintenance

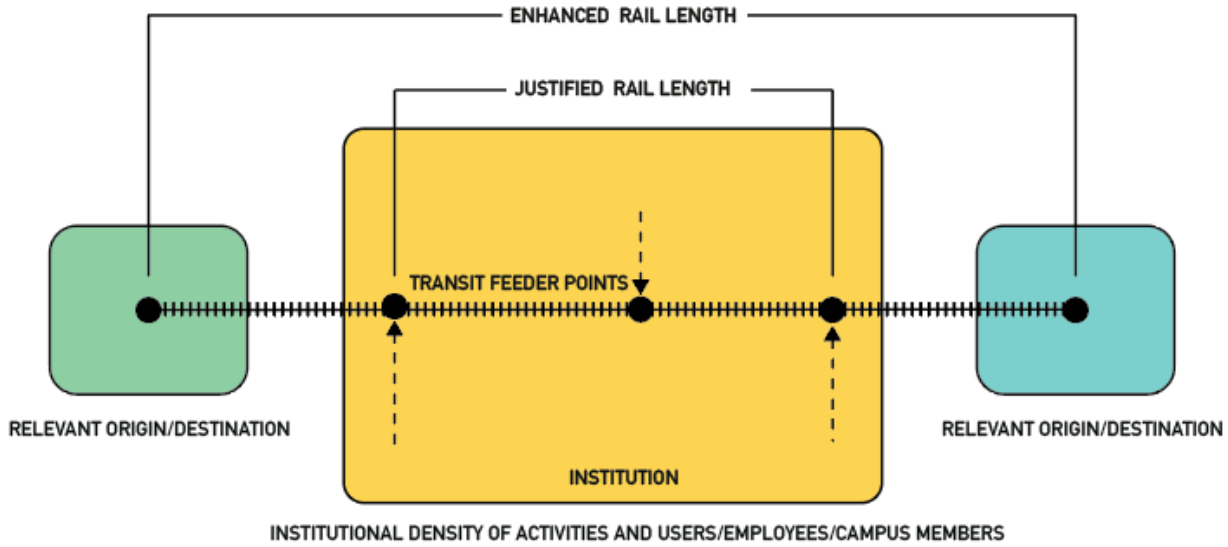


Figure 16: Diagram showing the uniqueness of an institution for rail transit

6.1. Political Framework

6.1.1. Transit Advocacy and Political Will

There is no doubt about the fact that transportation policy in the United States has prioritized and subsidized cars over transit. To reverse the entrenched policy bias against transit and win lasting change, American cities need strong leadership from their elected officials, an enterprising transit agency staff who are able to take risks and committed and sustained grassroots advocacy. The transit officials from Denver and Charlotte for example, stated that changing a city's transportation system is more successful and sustained when civic support for

new approaches is strong. At the same time the officials from Minneapolis-St. Paul acknowledged that identifying transit advocates in communities can generate support, discussion, passion and knowledge toward public transit.

Table 1: Rail transit politics and advocacy

City	Strategies - Politics and Advocacy
Charlotte, NC	• Sustained commitment to rail (inclusion in planning and discourse) • Focus on just rail planning (minimum/limited focus on buses) • Political support
Denver, CO	• Sustained commitment to rail (inclusion in planning and discourse) • Political support
Minneapolis-St. Paul, MN	• Sustained commitment to rail (inclusion in planning and discourse) • Community advocacy and support • Political support to change policies
Portland, OR	• Sustained commitment to rail (inclusion in planning and discourse) • Community advocacy and support

	• Political support

Applying this criterion to the institutional realm can help simplify certain challenges otherwise faced by towns and cities. Firstly, unlike other urban areas, institutions do not have the multi-level structure of political hierarchy. They are usually single decision-making organizations that have the capability to decide the best outcomes and provide services accordingly. Secondly, the density generated by institutions is willing to be captured through public transit options. Therefore, there is usually public and community support for transit within institutions.

6.2. System Planning

6.2.1. Initial rail length upon operation

The length of the rail is one of the most critical parameters in determining system costs. Therefore, while beginning to decide about the length of the rail line, the line is designed "optimally" in a way that minimizes user and operator costs. Therefore, the "optimal value" of the length of the line should minimize the sum of total transportation costs. The relationship between the length of the line and the demand for transit service is crucial as well. The main transportation costs considered as important while deciding the initial length of the rail are actual construction of the line, number of users and user time (the potential of future users does not get a lot of initial consideration). Therefore, the initial lengths are usually as short as possible, while capturing optimal ridership and having legitimate origin and destination points.

Newer rail projects design the actual rail line through an existing or a planned central business district (CBD). The CBD is considered as a hub for population and urban activity and

therefore a viable trip destination. There is evidence in transportation literature that within 4 miles of any CBD, rail lines and stations are incapable of branching out extensively (Pushkarev, Zupan and Cumella 1982). Therefore, for such short travel distances within the CBD, a change of transportation mode is rarely in the passenger's interest. Beyond the 4-mile mark however, there is a much greater possibility for rail lines and stations to branch out, reflecting the possibility that passengers will choose connector modes of transport if it is made convenient to do so. Therefore, for longer rail lines, there are multiple CBDs planned throughout the length of the rail line.

Table 2: Cities and their initial rail lengths

City	Initial Rail Length
Charlotte, NC	9.6 miles
Denver, CO	5.3 miles
Minneapolis-St. Paul, MN	11.6 miles
Portland, OR	15.3 miles

In an institutional setting, the campus or boundaries of the institution can be treated as a CBD because of its captive ridership and the concentration and density of activities. In that case there are some additional scenarios that need to be considered while deciding the length of the rail line:

- Trips originating and terminating within the campus (without going outside it)

- Trips connecting to feeder modes within the CBD for longer distance travel to nearby and relevant destinations.

The transit officials of all the four cities clearly indicated land acquisition and its budget as one of the primary factors for deciding the starting rail length. This is not particularly a setback for institutions as they not only own the land but are also guided by their own set of policies concerning land acquisition. Institutions frequently need to circumvent the restrictions imposed on them and develop mechanisms that enable them to become active players in the real estate market. As independently decision-making organizations, institutions do not face the same type of restrictions as other (non-institutional) agencies and with the appropriate resources, can make their presence more competitive (Perry and Wiewel 2005).

6.2.2. Main Ridership Generators

Transit ridership has long been the predominant indicator of a successful transit system. Ridership anchors two of the three legs of the classic transit-performance triangle of cost efficiency, cost effectiveness, and service effectiveness (Hanson and Giuliano 2014). As an indicator of service consumption, it provides information on both cost effectiveness in relation to service inputs (e.g., costs) and service effectiveness in relation to service provision. Unlike its counterparts, rail transit not only needs high passenger volumes to be cost-effective but also high concentrations of people and jobs around stations or at “feeder points”. Station area planning includes carefully engineered land use scenarios to generate ridership numbers and feed passengers to rail transit.

As the title suggests, **main generators are land uses that the rail transit can count on, in order to generate the majority of passengers for the system**. In the case of most transit lines, these generators are individual station locations because of the high density of passenger presence. In urban areas developing rail transit, transit-oriented development (TOD) serves the purpose of generating ridership through denser development efforts. TODs are carefully engineered to support high densities that justify the development of public transit facilities. Well-designed TODs not only increase ridership by transferring more passengers from automobiles to public transit but also serve as hubs for organizing community development and revitalizing urban districts. There is consensus among most stakeholder groups (politicians, planners, environmentalists, developers, community members, etc.) that the best places to concentrate urban growth are in and around rail stations and transit stops (Cervero, Guerra and Al 2017). A transit station therefore, needs to be more than just a transfer point (node versus place). Again, institutions already have dense clusters of transit users throughout their campuses and creating a sense of place around a transit station is quite manageable.

Table 3: Cities and their main ridership generators

City	Main Ridership Generators
Charlotte, NC	Downtown
Denver, CO	Downtown and financial district
Minneapolis-St. Paul, MN	Downtown and tourist attractions
Portland, OR	Downtown, business districts, neighborhoods

While in urban areas these generators are a direct result of the densification process, institutions are inherently core ridership generators because of the high numbers of riders they can capture through transit. Therefore, institutions tend to have denser concentrations of passengers and depending on their area, can serve their populations with efficient transit (or connect themselves to rail transit as we have seen in the case studies before).

The concept of "captive ridership" is crucial in institutional settings. **A "captive rider" can be defined as an individual for whom transit is the primary alternative for transportation. Captive riders choose transit over automobiles because it is highly lucrative, cost effective and convenient to do so.** Moreover, the employer (institution) can develop itself so that the transit is most convenient and partially or fully covered with free or discounted fare rather than building expensive parking facilities within its boundaries.

6.2.3. Density along rail

In terms of transit, density can be simply defined as the sufficient number of passengers within walking distance of the transit stop/station to allow the system to run efficiently.

The mechanism of density's influence on transit use is straightforward. On one hand, higher residential density around station-area neighborhoods brings more potential transit patronage. Without enough density and concentration of population, fixed rail transit can hardly receive a considerable number of riders within a reasonable, walkable spatial range. On the other hand, higher employment density near transit stations means more commute destinations in proximity to transit, which may likely attract more commuters to use transit (Cervero, 1994).

Besides, the analysis on the mechanisms of how density can constrain car use suggests that more people would switch from car to transit in dense areas where driving and parking costs are both high. Higher density mixed-use also generates origin and destination ridership.

Table 4: Cities and their estimated densities

City	Estimated Density for Rail Planning
Charlotte, NC	Medium density (~10,000)
Denver, CO	Medium density (~10,000)
Minneapolis-St. Paul, MN	High density (~20,000)
Portland, OR	High density (~20,000)

*The types values for densities have been prescribed by the American Public Transportation Association

Compared to the widely accepted argument on the impacts of density on promoting ridership, maybe a more useful topic is: what is the density threshold that could sustain a viable transit system? This is where institutional densities can be discussed. Large institutions can function as anchors to the transit corridor that play a significant role in generating ridership. Institutional densities fall into several main categories. Educational institutions, in particular colleges, universities, and other post-secondary institutions generate significant demand for transit on the part of students and staff. Large research and region-serving hospitals can also benefit locations near transit, generating trips throughout the day by staff and patients. Finally, civic and cultural institutions, such as libraries, community centers, museums, and city halls

attract significant travel by a variety of modes, including transit. Thus, all the land uses mentioned can act as “institutional generators”. Educational, research, medical, governmental (including military) land uses have centralized decision-making (location of ridership generating land uses and policies supporting transit).

6.2.4. Multimodal Connections

The most efficient transit systems around the world do not force passengers to travel a certain way. Rather, they are accommodating (more convenient and cost effective) of other modes of transportation that blend with transit and offer a wide range of choices for commuters. Multimodal access to public transportation therefore, considers and accommodates the many ways public transportation users get to and from a public transportation stop or center to access a public transportation service. Those methods include walking, bicycling, riding feeder public transportation systems (e.g., taking the bus to connect to commuter rail at a station), and driving.

The idea is that providing the infrastructure and support services for multiple modes to public transportation will increase use of the public transportation system. A successful integration between modes will likely increase the catchment area and subsequent use of public transportation. Multimodal transportation accounts for the differing capabilities of different modes, including their availability, speed, density, costs, limitations, and therefore their most appropriate uses. In many ways transit can be seen as an attempt to massively increase the quantity of residents and destinations within an easy walk of transit (Cervero & Kockelman, 1997; A. Guthrie & Fan, 2016). It is important to consider what makes a walk (or bicycle ride) easy, however? Answering this question requires consideration of how best to measure the

quality of bus, bicycle and pedestrian connections to rail, as well as acknowledging that "convenience" for bicycle and pedestrian transportation involves factors beyond distance and travel time, such as exposure to traffic and perceived safety (Tilahun, Thakuriah, Li, & Keita, 2016). In an institutional setting, all these decisions are made by the institution itself, a single decision-making body. Multimodal connections achieve two important goals:

- Connecting institutions to the larger urban setting (urban edge of the institution)
- Connecting the institution well internally

Below are the details of how the four case studies have handled multimodal transportation:

Charlotte, NC

The city of Charlotte has one of the most rigorous multimodal design programs in the country. The Charlotte Area Transit System (CATS) has combined their existing rail transit with greenways (pedestrians and bikes), bus transit, automobiles (parking and kiss-and-rides) and street connections. Since opening its first 9.3-mile long light rail line, Charlotte has always considered multimodal transportation as a part of its future transit infrastructure planning. For example, CATS has planned for a secondary bus transit hub once the capacity of the current bus hub was calculated. There are plans in place for on-street bicycle routes, rails and trails (almost 5-miles of which has been constructed since 2007) and additional off-street connections are desired to provide improved linkages between neighborhoods and attractions.

The University of North Carolina is serviced by rail transit through two stations within its campus, which serve as the internal campus connectors as well. The pedestrian connectivity is achieved by providing sufficient sidewalks and crosswalks between the stations and campus. The

existing parking facilities adjacent to the stations accommodate the automobiles, however, given the efficiency of the rail and good pedestrian and bike connectivity, most students walk to the train stations. Bicycle lanes (typically a part of most campuses) are an intrinsic part of station connectivity as well and CATS does have plans for more bike connectivity in the future (Transportation Plan 2030).

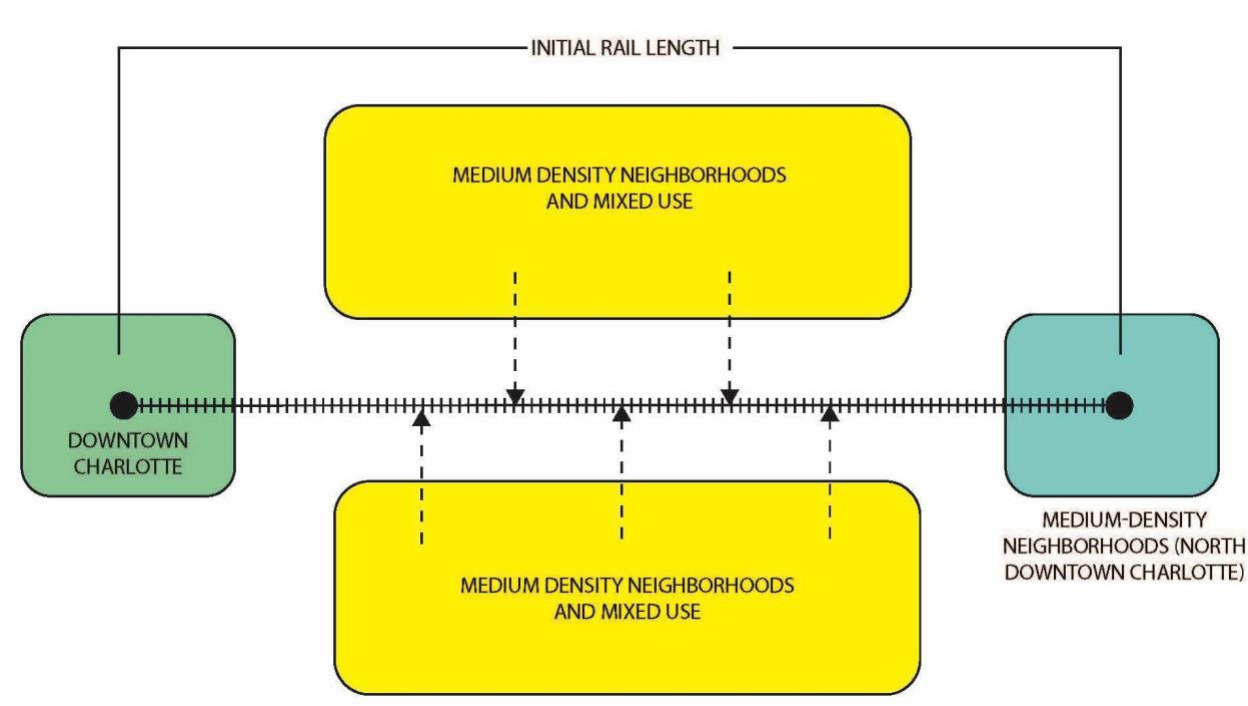


Figure 17: Diagram showing rail connections for Charlotte's first line

Denver, CO

Before beginning the operation of their first downtown line in Denver, the Regional Transportation District (RTD) conducted an intermodal facility and connections study to connect intercity, regional, and local transportation modes with emphasis on how to integrate the needs of future and existing private development and public infrastructure improvements in the vicinity. Their work focused on the items listed below:

- Types of modes to be included

- Relationships among the modes
- Opportunities and constraints of terminal and adjacent areas
- Space and operating requirements of individual modes
- Facility layouts for development scenarios
- Technical and financial analysis

In 1994, when the first rail transit began operation, RTD had a fairly complex bus operations system. The inclusion of rail transit in the core of the Denver central business district (CBD) required detailed analysis and reworking of the system wide bus operating plan including the following goals:

- Avoid having bus routes competing with the rail line
- Keeping buses out of CBD through feeder bus services to rail transit (almost 500 daily bus trips eliminated for efficiency)
- Continue providing cross-town service by rerouting away from CBD

The University of Colorado's downtown Denver campus is also served by rail transit. There is a Multi-Station Plan & Mobility Study that explores a strategy for activating the stations in the university campus and improving the connectivity network in the station area and surrounding neighborhoods. This plan incorporates future multimodal improvements like bicycle lanes, pedestrian bridges, redesigned intersections, transit plazas for public, wayfinding systems, etc.

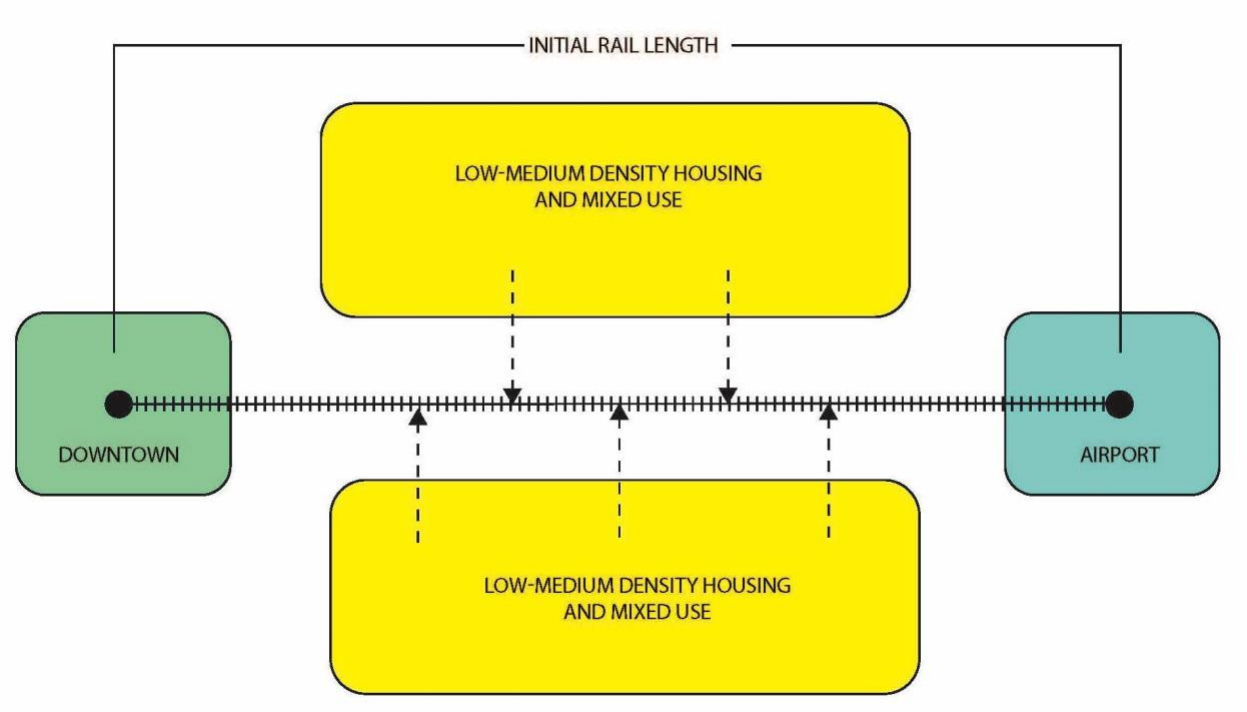


Figure 18: Diagram showing rail connections for Denver's first line

Minneapolis-St. Paul, MN

In comparison to other cities formulating their own plans, Minneapolis has adopted its Statewide Multimodal Transportation Plan to inform the city's multimodal initiatives along the Hiawatha rail line. Following are the strategies the city relies on:

- Define priority networks for all modes based on connectivity and access to destinations, and integrate the networks into decision-making
- Identify and prioritize multimodal solutions that have a high return on investment
- Identify and prioritize low-cost improvements to accelerate social, economic and environmental benefits when large-scale solutions cannot be implemented in the foreseeable future
- Support and develop multimodal connections that provide equitable access to goods, services, opportunities and destinations

- Provide greater access to destinations and more efficient, affordable and reliable movement of goods and people throughout the Twin Cities metropolitan area
- Improve freight operations and intermodal connections for better access to the transportation system
- Provide transportation options that improve multimodal connections between workers and jobs
- Develop and improve multimodal transportation options within and between cities and regions
- Develop and improve connections between modes of transportation

The more recently built Metro Green rail line began serving the University of Minnesota campus in Minneapolis in 2014. It is an 11-mile light rail route connecting downtown Minneapolis and downtown St. Paul through the university. In order to achieve multimodal planning, the rail stations within the university are connected by a transit-pedestrian mall and only buses, emergency vehicles, cyclists and pedestrians are allowed through this street in addition to trains.

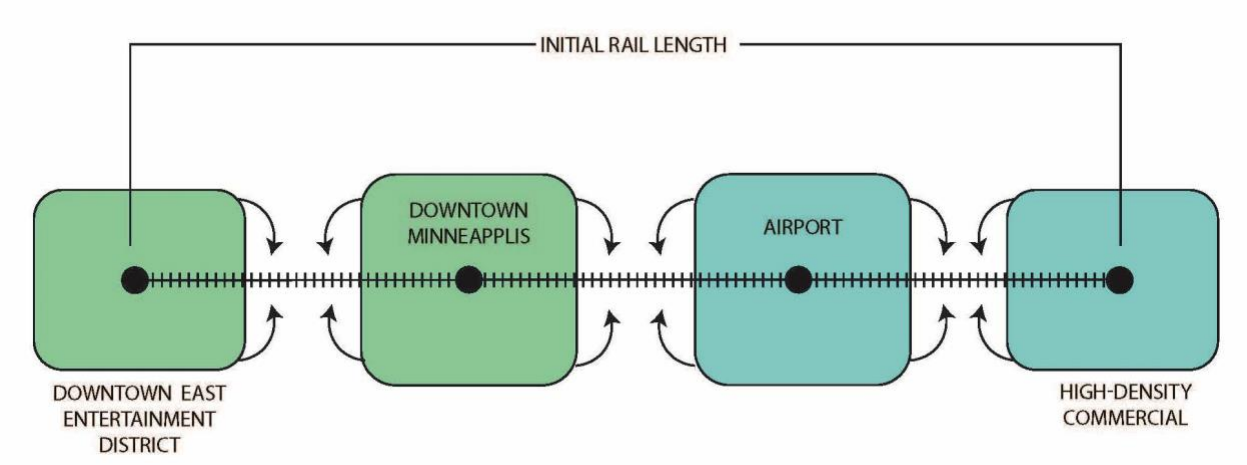


Figure 19: Diagram showing rail connections for Minneapolis-St. Paul's first line

Portland, OR

Portland's transportation agency TriMet has been leading innovations through their multimodal transportation investments. The agency's Mobility on Demand (MOD) platform necessitates innovative technological solutions; strong public-private partnerships; incentives to shift travel behavior; data and performance metrics; and the expansion of operations to support the management of a more holistic mobility ecosystem. TriMet has partnered with Uber, SHARE NOW and BIKETOWN to use their current location information on their online platform. Using the real-time locations of buses and trains along with real-time availability of cars and bikes from these private transportation companies, the tool can piece together single trips using multiple modes. This online platform is designed to be easily replicated by transit agencies in other cities. Since it uses open source technology and open data, including OpenStreetMap, other transit agencies could quickly adjust the trip planner for their system.

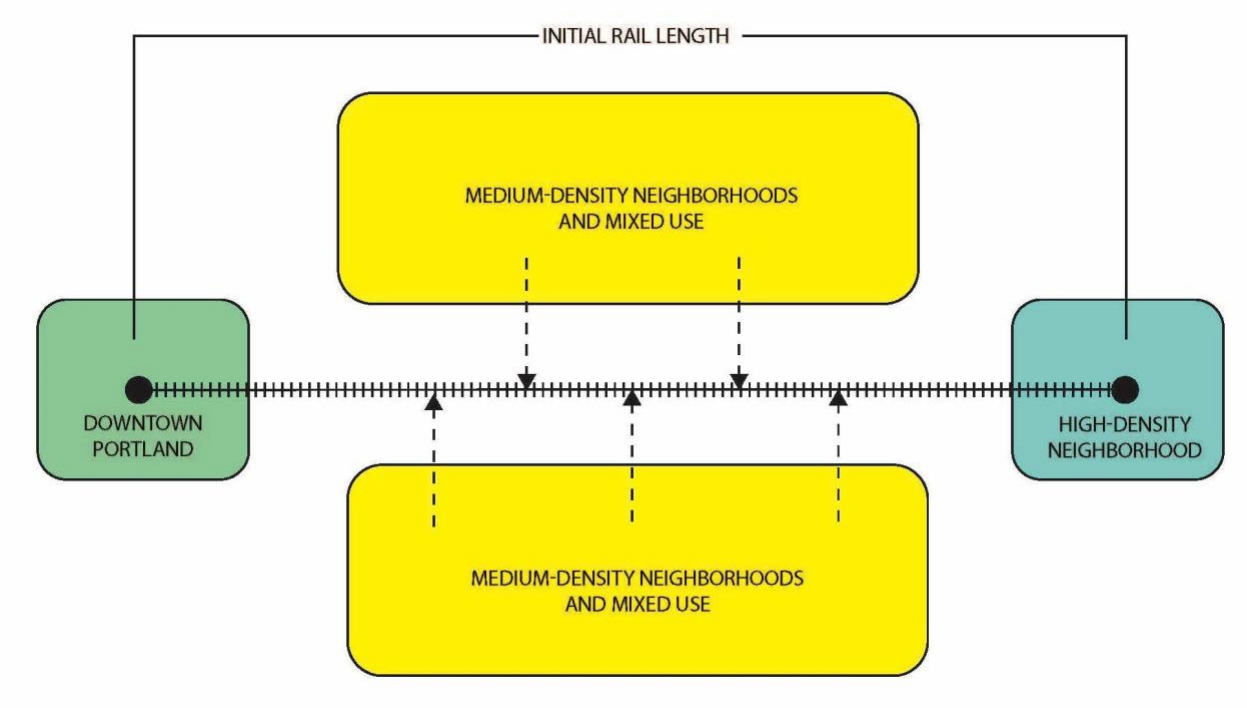


Figure 20: Diagram showing rail connections for Portland's first line

While applying this criterion in an institutional setting, it is important to note that an institution has multiple destinations within its boundaries.

6.2.5. Ridership

Transit ridership refers to the number of passenger boardings on public transportation. Transit ridership can be measured in terms of weekday boardings or in terms of annual boardings for a typical resident (per capita). Transit systems are capable of attracting more passengers when they are multi-destination in nature (Cervero, Guerra and Al 2017). Multi-destination transit systems appeal largely to transit-dependent riders (also called captive riders), whose demand for transit service appears to be highly elastic with respect to the shortening of transit travel time between origin and destination. The focus on institutions for this research taps the

commuter market, in particular riders who have a choice between using public transit or driving a car for their trip to and from campuses and almost always select public transit because of its convenience and efficiency, providing a steady daily ridership within the institution.

It is evident from the case studies that all the four cities (Charlotte, Denver, Minneapolis and Portland) under-predicted their daily ridership numbers while designing the transportation systems. Subsequently, once the rail systems began operation, those numbers were exceeded (the projected and actual ridership numbers are listed in the table).

Table 5: Cities and their numbers for projected and actual riderships

City	Projected Ridership	Actual Ridership
Charlotte, NC	9,100/day	18,000/day
Denver, CO	8,400/day	17,900/day
Minneapolis-St. Paul, MN	20,000/day	24,800/day
Portland, OR	18,000/day	22,000/day

Table 5: Cities and their numbers for projected and actual riderships

For institutional settings, the calculations for ridership are uncomplicated because of the presence of captive passengers. It is imperative that most members of the institution will be interested in using transit depending on the size and nature of the campus.

6.3. Finance

6.3.1. Overall Funding Structure

The funding structure for any startup rail project can be explained using two main points:

- The investment required to build rail transit (first line)
- The sustainability required to continue (operate, maintain, replace, expand)

Federal funding for transit comes primarily through the U.S. Department of Transportation (DOT) and is administered by the Federal Transit Administration (FTA). These funds are appropriated from either the Highway Trust Fund or the general fund. According to FTA, fare-box revenues account for only about 40% of public transit system operating costs and maintenance, so transit systems must generally rely on additional funding from Federal, state and local sources as well as private investment (American Public Transportation Association). Since 1997, 2.86 cents on every gallon of federal fuel tax collected has been dedicated to the Mass Transit Account (MTA) (American Public Transportation Association). Funding from state and local authorities may come from numerous sources including sales taxes, property taxes, income taxes, and direct transit system taxing authority.

As is the case with state highway programs, state transit programs may receive a large percentage of funding from federal sources. This funding is in turn awarded in the form of grants that typically require matching funds depending on the type of program, to individual transit systems by formulas which may vary from year to year. States generally do not own capital equipment for transit and do not provide direct transit services. State and federal funds are disbursed to cities, counties, transit authorities and transit providers on a reimbursement basis, so

expenses must be incurred by the provider prior to disbursement by the State or the Federal Transit Administration (FTA). State funds may be used by providers to meet the matching requirements of federal grants.

However, many cities make the choice of generating transit funding through local sources not only to supplement, but also to ensure stable funding in the absence of federal and state funds. Following are some of the techniques local jurisdictions use, in order to fund transit services and infrastructure.

- **General Sales Taxes**

  Sales taxes are the most common source of funding for local and regional transit services. They generally provide the greatest revenue yield and stability and are broadly accepted as a source of revenue for public transportation (Elmer and Leigland 2014).

- **Vehicle Leasing and Rental Fees**

  Municipal and regional authorities may opt to use revenues from locally imposed taxes on the rental of vehicles to fund transit services. Vehicle rental companies are typically responsible for reporting and remitting these taxes to the regional authority. Similar taxes may also be levied on the leasing of vehicles, which generally take the form of a sales tax on the monthly lease payment. For example, Allegheny County in Pennsylvania has enacted a $2 rental car fee to help support transit services provided by Port Authority Transit Services in the Pittsburgh metropolitan region (Elmer and Leigland 2014).

- **Parking Fees and Fines**

Parking fees may be imposed to achieve a number of municipal goals including revenue generation, traffic management and mode shift. Local transit agencies may receive significant levels of funding for operations from the parking fees and parking fines levied by the city or other regional government or they may receive parking related revenues generated at facilities owned by the transit authority. The San Francisco Metropolitan Transportation Agency (Muni) receives a significant amount of revenues for the provision of transit services through parking fees and fines. Eighty percent of city revenues are dedicated to Muni operations (Elmer and Leigland 2014).

- **Property Taxes**

Property taxes are assessed on the value of land and buildings and are the principal source of revenue for local governments. Portions of local property tax revenues may be authorized for use by special districts and authorities such as transit authorities. For example, the Metro Transit Agency in Minneapolis, MN receives support for transit operations through property tax revenues (Elmer and Leigland 2014).

- **Lease Revenues**

Transit service providers often generate revenue by leasing various portions of their operations, such as parking facilities and terminal stations, for use by private enterprises (Elmer and Leigland 2014).

- **Hotel/Motel Taxes**

Hotel/motel taxes are a common revenue generating mechanism employed by municipal and county governments. They are often only applied on certain days of the week, month or year and revenues are often used in the development and operation of tourism related facilities (Elmer and Leigland 2014).

- **Tax-increment Financing Districts (TIFs) or Tax Allocation Districts (TADs)**

Tax-increment Financing Districts (TIFs or TADs) are focused on capturing the added increment of a future stream of increased taxes that result from an increase in property values due to public investments. The excess tax increment is used to repay the public improvement bonds used to fund the improvements that led to the increase in value and tax returns. The revenues derived from these districts may be used for a number of purposes, including transit development (Elmer and Leigland 2014).

- **Transportation Development Districts (TDDs)**

Transportation Development Districts (TDDs) are a form of community improvement or community facilities district that is intended to provide a means of raising funds specifically for transportation improvements. They are generally aimed at financing the cost of a specific project and may be applied to developing or improving transit services. These districts typically raise funds through the issuance of bonds, which are generally supported by tax increment procedures or dedicated sales taxes. Tax increment procedures are established by various state and local entities as a process for determining the value of land prior to development so that the incremental increase in

value due to development can be appropriately credited to the desired programs. Bonds are issued based on the expected incremental increase and the revenues directed to the project. The enabling legislation that is required for the development of TDDs varies based on the entity seeking to establish the district (Elmer and Leigland 2014).

- **Value Capture**

Success in creating effective transit-oriented development could mean substantial economic value capture. Land value capture is the most effective when:

- There is frequent and good quality transit
- Good connectivity between transit and community
- Provision of community amenities and dedication to placemaking
- Scorekeeping and attention to financial returns

Capturing value, accrued either to the household or the community, should be a key objective of transit-oriented development. This allows people to lead affordable lifestyles and lets communities reinvest the profits derived from their good work.

For local governments, value capture can mean higher tax revenues from increased sales and property values. For the transit agency, value capture means both, lease revenue from joint development and revenue from fare boxes. Denser developments around transit can increase the number of passengers who access the system on foot, which is a much cheaper way to attract passengers than dedicating expensive land for parking or operating feeder bus service (Elmer and Leigland 2014).

In the context of institutions specifically, most transit programs are largely funded by a mandatory fee paid by members regardless of their use of the transit. In addition, many institutions also include funding through parking permits and fine revenues, institutional funds, and operating assistance funds from federal, state, or local governments. Therefore, it is important to note that federal and state funds are not the primary sources of financing transit services and infrastructure within institutions.

It is also important to note that from the author's conversations with the heads of the four transit agencies, land acquisition was one of the most expensive and time-consuming items on the transit implementation side. The land acquisition process involves engineers from the transit agency who prepare legal descriptions of the property required based on right-of-way drawings. These descriptions are then forwarded to the cities. Based on these descriptions, title companies perform title searches for each required parcel. Upon completion of this work, title reports for each parcel are transmitted to the cities. City staff is responsible for obtaining appraisals, making offers, negotiating settlements and making the land ready for construction. The cities can also file for condemnation when offers are refused or negotiations with property owners fail.

The critical path schedule for any rail project tends to travel through land acquisition, utility relocations, civil construction, traction electrification, signal systems, and testing and start-up. Timely acquisition of right-of-way therefore, becomes a major factor in meeting the scheduled timelines and reducing the risk of costly delays. In the case of an institution, it commonly owns the right-of-way (avoiding the time consuming process of land acquisition).

In the context of institutions specifically, this land acquisition and right-of-way step is largely simplified because the land upon which the rail needs to be built is owned by the institution. Thus, institutions can get closer to the design and programming of rail transit much faster than cities and other urban areas. Additionally, most transit programs in institutions are largely funded by a mandatory fee paid by members regardless of their use of the transit. Many institutions also include funding through parking permits and fine revenues, institutional funds, and operating assistance funds from federal, state, or local governments. Therefore, it is important to note that federal and state funds are not the primary sources of financing transit services and infrastructure within institutions.

Below are the funding structures adopted by the cities studied for this research:

Charlotte, NC

The overall funding structure adopted by the Charlotte Area Transit System for the initial length of the rail can be divided into three parts:

- Federal funding (50%)

  The city received funds through the New Starts federal grant
- State funding (25%)
- Local sales tax (25%)

Denver, CO

- 100% local funding

Denver is one of the very few cities in the country that built and began the operation of its first 5.3-mile rail line entirely through local funding. Rail was always a legislative priority for the

city and it was divided into seven transportation districts. Thereafter, each district was permitted to collect a "use tax" on goods and services purchased outside the district for use within. This use tax (0.6% on retail sales) was solely responsible for funding the first 5.3-mile rail line in downtown Denver.

Minneapolis, MN

- 60% federal and 40% state and local funding

The federal funding was provided through appropriations and grants. Additionally, there were multiple sources of state and local funding including the Minnesota Legislature, the Metropolitan Airports Commission, Hennepin County and the Minnesota Department of Transportation.

Portland, OR

- 100% federal funds (diverted from highways)

Following some interesting turn of events (mentioned in chapter 3), the City of Portland received federal approval to use their freeway funds to build rail. Therefore, the first Banfield rail line (15.3-mile long) was built entirely using Portland's federal highway funding.

6.3.2. Cost of Rail Per Mile

Each transit provider has their own list of items for inclusion in the per mile cost of rail transit. Therefore, no two urban areas have the same criteria to determine the cost per mile for rail. Two of the largest costs that significantly impact the cost per mile of any rail transit project are land acquisition and physical rail alignment. Land acquisition has already been explained

above. Rail alignment requires the decision of whether the alignment will be at grade, elevated, or underground—with underground projects costing much more than elevated, which costs more than at grade. Therefore, the systems that use existing railroads cost much less per mile than those which need to be newly constructed.

In the next chapter, the author will provide thresholds and ranges for all the criteria mentioned above (from urban contexts) and apply it to an institutional context. This second tier of case study will focus on the 5.5-mile rail line that passes through the heart of the University of Georgia campus in Athens, Georgia.

6.3.3. Transit Fare Structure

In this section, the researcher will not be focusing on the standard ticketing for rail transit as this method is standard and constant for all modes of transit. Instead, the focus will be on institutions and the accommodations that are made in order to promote transit use on campuses. Most institutions generate and capture enough passengers for the rail transit to ensure its viability. Therefore, transit providers provide the members of the institutions with transit pass programs to achieve the required ridership levels on the systems. Some benefits of transit passes are as follows:

- They cost less than the amount riders would otherwise pay for regular monthly passes or tickets
- They reduce overall driving (in personal automobiles) on campuses
- They help reduce traffic congestion in and around the campus and local community
- They stimulate public transportation ridership

- They provide a regular and reliable revenue source for transit authorities
- They help build transit loyalty so that the passengers become transit riders wherever they go in the future
- They help cover some of the operation and maintenance costs of the system
- They replace expensive campus parking and decks

6.3.4. Transit Operation and Maintenance Costs

Annual operating and maintenance costs include the ongoing costs to operate and maintain the transit system. These costs typically include administration, labor (operations and maintenance), vehicle maintenance, fuel, insurance, etc. Specifically, for rail, these costs include vehicle maintenance, facility maintenance and track maintenance. Similar to ridership numbers, transit providers will predict the cost of rail construction and operation and the actual costs should be fairly close to the projected ones (low variance). The operating costs for the four case studies can be seen in the summary table provided.

In the next chapter, the author will provide thresholds and ranges for all the criteria mentioned above (from urban contexts) and apply it to an institutional context. This second tier of case study will focus on the 5.5-mile rail line that passes through the heart of the University of Georgia campus in Athens, Georgia.

CHAPTER 7

TESTING CRITERIA AND RESEARCH TRANSFERABILITY

The previous chapter looked at the factors/criteria that helped transit providers initiate rail transit within an urban context. Moreover, the author explained the importance of those criteria within institutional settings so that they can be applied to the main institutional case study in this chapter, the University of Georgia in Athens, Georgia. We will now be testing the criteria that stemmed from an urban context, on an urban- institutional context. The table in this chapter (table 1) from the case studies summarizes the responses for the evaluative criteria that initiated the first rail line(s) in an urban context. The second table below (table 2) lists the average and highest values of the evaluative criteria providing thresholds and threshold ranges for the rail line through UGA (institutional context).

At this stage, it is vital to define the term "threshold". A threshold in terms of rail transit is the value, once reached determines the success or strong possibility of the occurrence of a rail transit system (Pushkarev 1994). It is a "driver" that contributes to the launching of rail transit in an urban context.

As noted, the case study for this purpose is the University of Georgia campus in Athens, as mentioned earlier. We will apply the thresholds established in the previous chapter to the existing conditions and numbers in UGA. The researcher will elaborate on each criterion within

	Charlotte Area Transit System (CATS) Charlotte, NC	Regional Transportation District (RTD) Denver, CO	Metro Transit Minneapolis-St. Paul, MN	TriMet Portland, OR
Start year of operation	2007	1994	2004	1986
Initial rail length upon operation (miles)	9.6	5.3	11.6	15.3
Main ridership generators	Downtown	Downtown tourist and business districts	Downtown and tourist attractions	Downtown, business districts, neighborhoods
Level of densities around stations and rail line	medium density	medium density	high density	high density
Multimodal connections to transit	buses, bikes, rails and trails	buses, bikes, sidewalks	buses, bikes, sidewalks	buses, bikes, sidewalks
Projected ridership per day	9,100/day	8,400/day	20,000/day	18,000/day
Actual ridership per day	18,000/day	17,900/day	24,800/day	22,000/day
Time span from planning to operation	1996 - 2007 (11 years)	1987 - 1994 (7 years)	1980 - 2004 (24 years)	1973 - 1986 (13 years)
Overall funding structure	New Starts Federal Grant, State funds and local sales tax	Locally funded sales tax	Federal and state funds	Federal funding (diverted from highways)
Transit fare structure	Subsidized annual passes for participating organizations	Subsidized annual passes for participating organizations	Subsidized annual passes for participating organizations	Subsidized annual passes for participating organizations
Operation and maintenence costs	$10 million/year	$14 million/ year	$12 million/year	$8 million/year
Cost of rail per mile	$50 million	$22 million/mile	$52 million/mile	$14 million/mile

the institutional setting of UGA and conclude whether UGA is capable of initiating rail transit through its campus, when compared to urban contexts and situations.

Table 6: Thresholds from case studies and for UGA

	Average threshold (from case studies)	**Highest value threshold (from case studies)**	**Threshold values for Athens, GA and UGA**
Initial track length	10.45 miles	15.3 miles	5.5 miles
Density levels	Medium-high density	High density	Medium-high density
Ridership (projected)	13,875/day	20,000/day	30,137/day
Cost of rail per mile (2022 dollars)	$59.43 million	$92.28 million	Range: $59.43-$92.28 million
Operation and maintenance costs (2022) dollars	$39.25 million	$26.56 million	Range: $39.25-$26.56 million

7.1. Political Framework

7.1.1. Transit advocacy and Political Will

The city of Athens and the University of Georgia specifically, are not new to the concept of public transportation. As it can be seen from the background in chapter 2, the University of Georgia (UGA) has always been a part of the transportation history of the town of Athens. This is because UGA offers a consistent and reliable supply of captive riders to its own and the city's public transit systems. After the discontinuation of street cars in 1930, UGA re-established public transportation in the form of bus transit followed by the city of Athens buses in 1976.

Thereafter, UGA provides a connected network and accessibility of its campus bus transit and recently introduced a fleet of additional electric buses to increase transit frequency. However, the campus bus transit is reaching its carrying capacity with the number of passengers increasing each year (Shearer, Athens Banner Herald, 2018). The current campus public transportation is challenged by increasing ridership as well as high parking fees (11 million boardings annually on a 660-acre main campus).

"We are certainly pushing capacity when it comes to getting around the campus or in the city."

-Jere Morehead, President, University of Georgia (2018)

(quoted from an article in Athens Banner Herald)

The high transit ridership numbers on campus however, show that there is a transit supportive population, willing and able to take transit on a daily basis through campus. The university's will to expand the public transit system is visible, through its efforts to add more buses to the existing fleet and acceptance of the fact that increased ridership is posing a challenge to expanding the bus system further and efficiently travel within the campus. Moreover, there is the added value of educating (introducing) a student population about sustainable commuting patterns and thereby influencing the travel behaviors of the university community at large.

This doctoral research will add to the already existing transit advocacy and research on the UGA campus by introducing rail transit as a campus transit option. It will provide the university with a framework to apply the same political will it has for buses, to trains. The rail

and bus transit systems will complement each other instead of competing and UGA will be able to handle the rising demand for more efficient campus transportation.

7.2. System Planning

7.2.1. Initial Rail Length

The initial rail length for a campus rail through Athens as discussed in the previous chapters is around 5.5 miles. The starting point of the railroad is North Avenue north of downtown and it ends south from there to the end of Milledge Avenue. Considering the threshold of 10.45 miles from the previous chapter, the rail line length of 5.5 miles is workable for Athens, given the fact that it passes through a densely populated campus. The university owns the rail right-of-way and no additional land acquisition will be required in this case.

Currently there is an existing, unused rail line that will need to be refurbished. Rail has always been a part of the history of Athens and therefore this railroad has a historic value. Rail transportation literature suggests that abandoned railways should be considered for reactivating the urban rail transit systems in combination with the existing transportation network according to the growing needs of an urban area. Retaining the transportation function and providing better connectivity is one of the most effective strategies for reusing abandoned rail lines (Zhang, Dai and Xia, 2020).

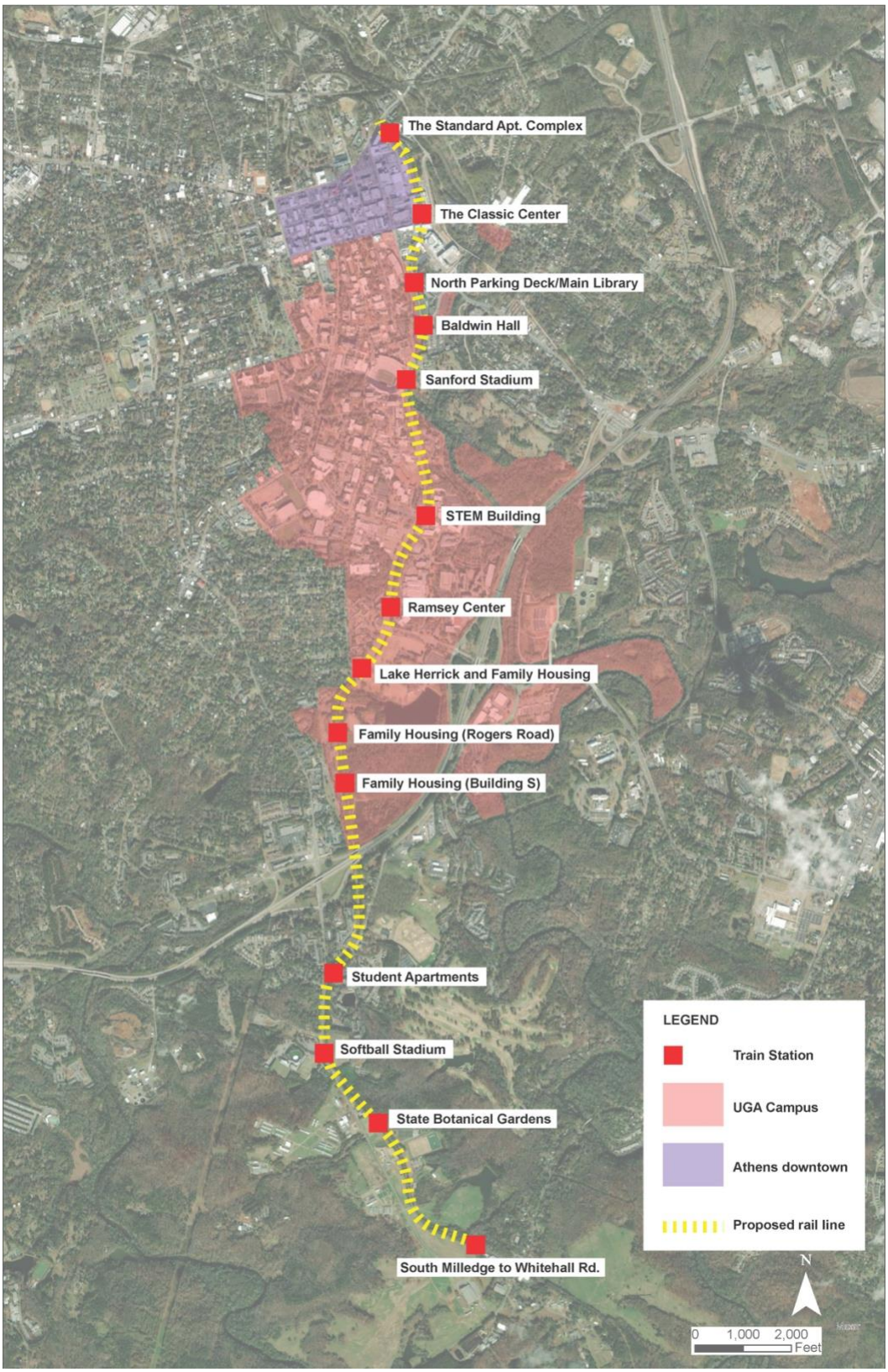


Figure 21: Map showing the proposed rail line and stations, UGA campus

The current unused rail line through Athens is actually a small part of the larger, unused, 38-mile rail line between Bishop, GA and Center, GA. At present, this unused section of the rail is classified as a Class 3 freight line (short line). Athens lies approximately at the center of this larger line, providing a future connection to the Greenfield line selected by the Georgia Department of Transportation (GDOT) for high speed passenger rail between Atlanta and Charlotte. At present, the corridor is classified as a partially active short line for freight transportation. This freight line has been purchased by a local short line operator, Hartwell Railroad and therefore, the opportunities to plan locally for the corridor in the future, have opened up. Due to the existence of this freight line and its eventual connection to Atlanta, the freight option will have to remain active in Athens as well. Therefore, Athens and the University of Georgia will have to share a track between freight and passenger rail for this corridor planning, for the future. Shared lines between passenger and freight rail are more justifiable, especially in densely populated urban areas. Another factor in the equation is freight liability as compared to passenger liability (the former has a higher liability). Freight liability however is significantly mitigated when the passenger agency is the owner of the track. Reduction of exposure to risk of claims from passengers can be an incentive for freight railroads to sell assets to public entities, particularly in jointly operated low-freight volume corridors (American Public Transportation Association).

The first RTD rail line to use a shared freight corridor was the Southwest light rail. This line was built in 2000 and shares 11.8 miles of right of way (ROW) with either Burlington Northern and Santa Fe Railway (BNSF) or the Union Pacific (UP) railroads in a consolidated main line. This is a true shared corridor where BNSF, UP, and RTD own different portions of the

corridor, and everyone has tracks on each other's property. RTD made an Intergovernmental Agreement (IA) with every community along the corridor before entering into negotiations with the freight railroad companies. This move helped define RTD's plans along the shared corridor and clarity on its own and the community responsibilities.

The issue of shared use corridors between passenger and freight rail operations continues to be extremely important in and between metropolitan areas in the United States. As demand for rail transit, commuter rail, and intercity passenger rail has been increasing in recent years, agencies responsible for providing service are faced with numerous challenges to extending route networks. One potential avenue for expanding passenger rail service is to utilize existing rail corridors that are typically owned and operated by freight railroads. As freight rail traffic has fluctuated on some of the corridors most in demand and in an effort to increase revenues, freight railroads have entered into agreements with passenger rail operators to allow access to their corridors for the purpose of providing passenger rail service. These agreements specify the terms under which public agencies are permitted to run passenger rail operations along freight rail corridors.

In the case of UGA, the freight connection will be a provision for the future and therefore inactive until freight transportation is expanded for the line being considered for this research and the right-of-way needs to be shared with the passenger rail. It is not a Class 1 type of railroad, which is a dedicated, heavy freight traffic railroad with an operating budget of over $500 million, but a Class 3 railroad because it is classified as a short line.

7.2.2. Main Ridership Generators and Multimodal Connections

The University of Georgia's captive passengers are the primary source of rail transit. Additionally, the station locations on the rail transit map show densely-populated collection points on campus. These collection points are also multimodal in nature with high connectivity to buildings, businesses, recreational and parking facilities. The campus is a medium-high density zone threshold in this case.

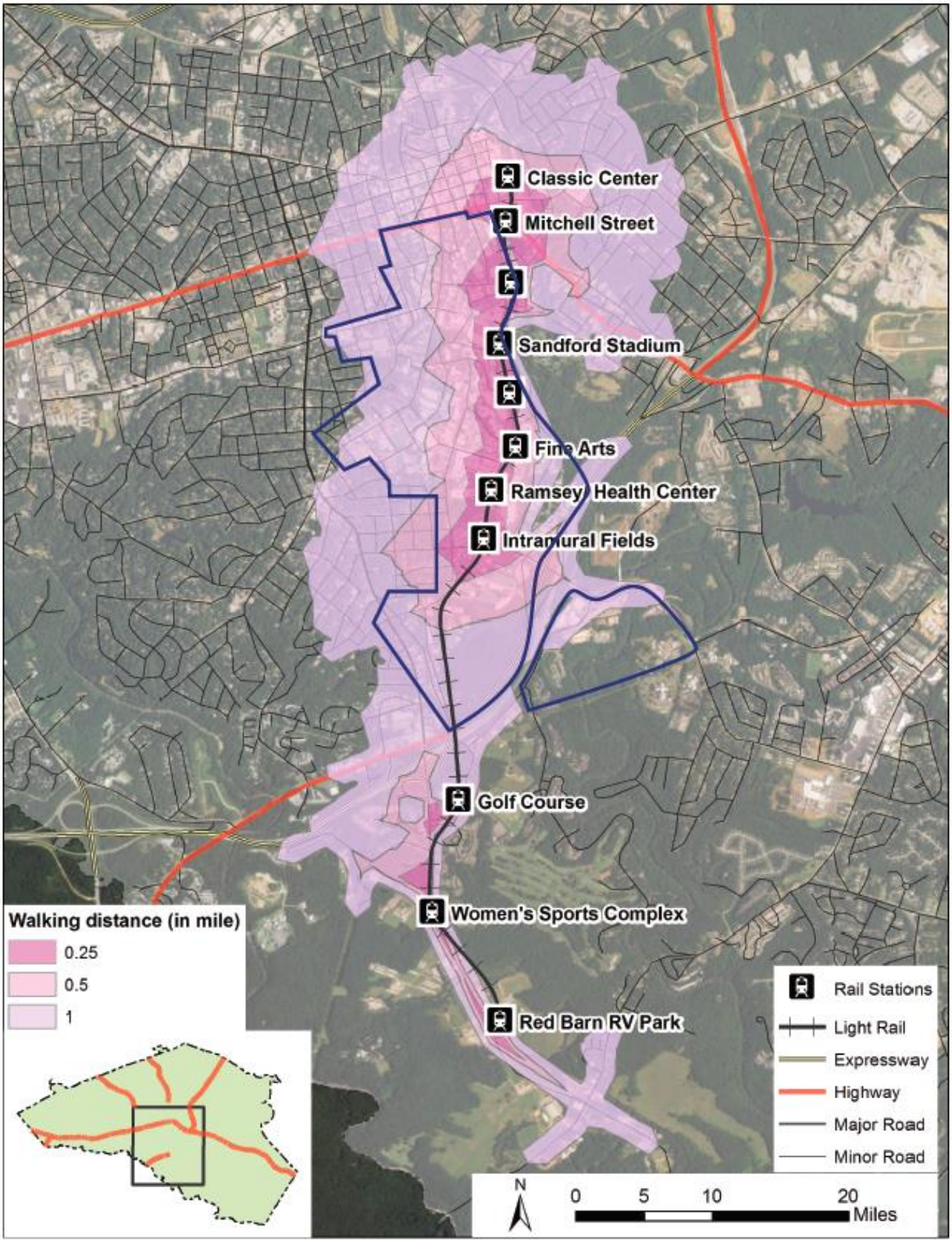


Figure 22: Map showing walkability around the rail line

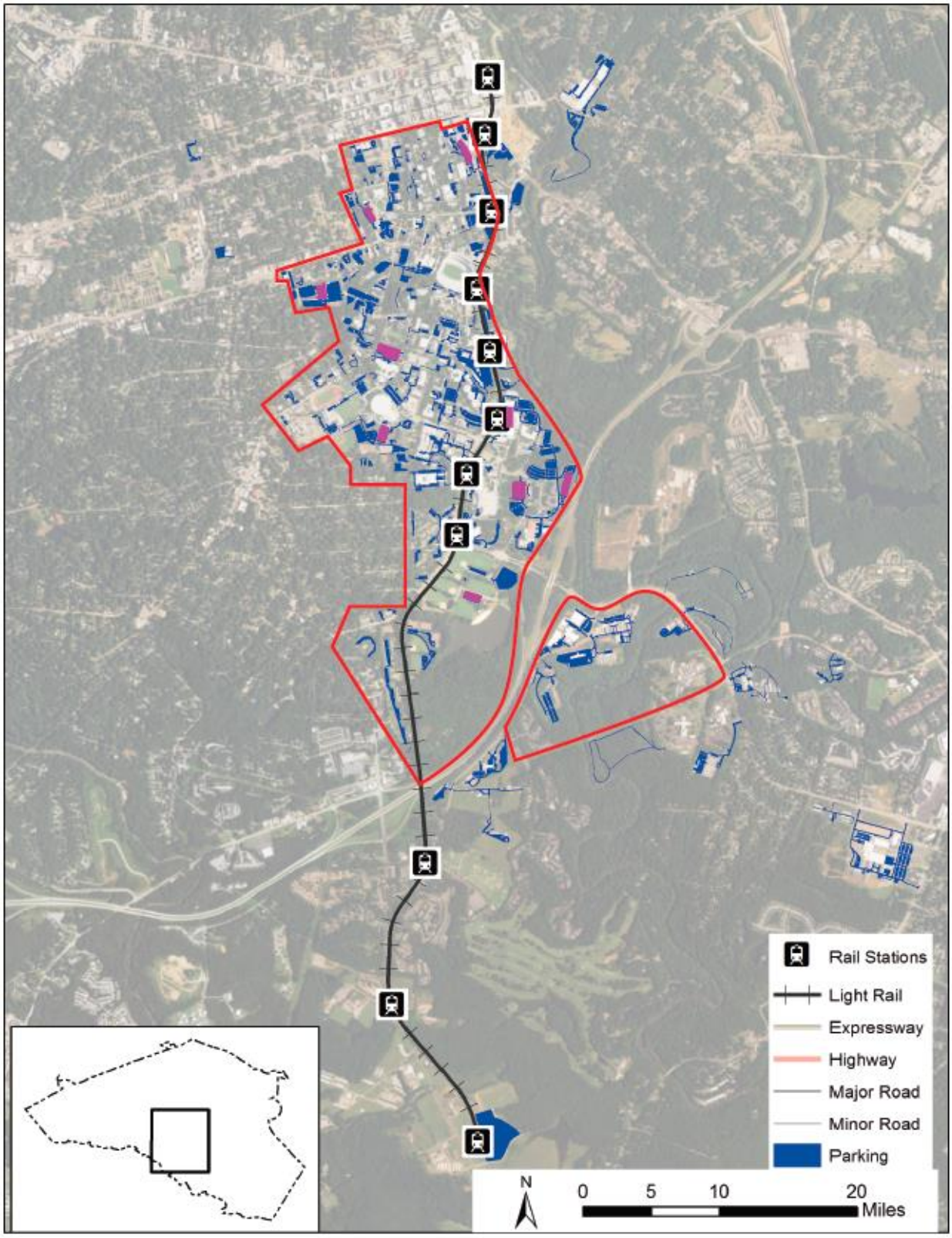


Figure 23: Map showing the locations of surface parking (blue) and parking decks (pink)

7.2.3. Ridership

The existing annual ridership that the university is able to capture on its existing bus transit is 11 million, which means around 30,137 passengers take transit on a typical workday. This number is much higher than the established threshold of average projected ridership, which is 13,875 riders per day. Additionally, the number (30,137) also exceeds the highest value of ridership from all the case studies, which is 20,000 passengers per day (Minneapolis, MN).

This existing ridership of 30,137 per weekday in Athens is currently being captured by bus transit alone, swiftly reaching its optimum carrying capacity. Along with the UGA campus bus transit, there is a city bus ridership to and from campus that may also be "captured" in part by the rail transit corridor. Therefore, making a conservative guess, the buses can be easily rerouted to feed into the rail transit and transfer at least 15,000 to 20,000 passengers on a typical workday onto trains. This number will increase each year and both systems will be able to handle the increased load of passengers together.

This conservative estimate of 15,000 to 20,000 passengers per day fits within the established thresholds as well, required for the initiation of rail transit (average = 13,875/day and highest = 20,000/day). The author has worked out changes in some of the existing bus routes to transfer the bus ridership to trains. If rerouted to compliment rail transit, 6 to 8 miles of bus lines can be eliminated (collectively). Thus, both modes of transportation can work together to meet the increasing transportation demands of the campus. The same system can be applied to the Athens Transit (city) buses.

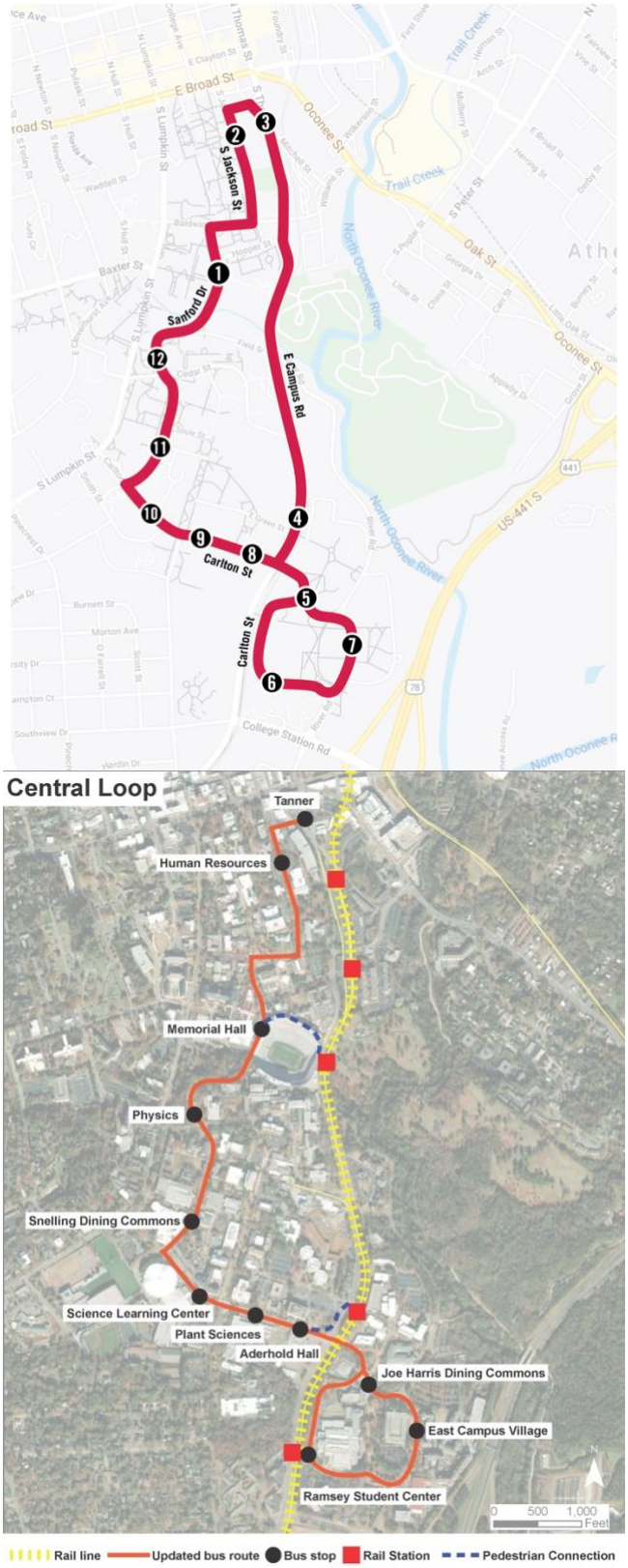


Figure 24: Map showing the existing route (top) and the rerouting of the Central Loop UGA Transit route (bottom)

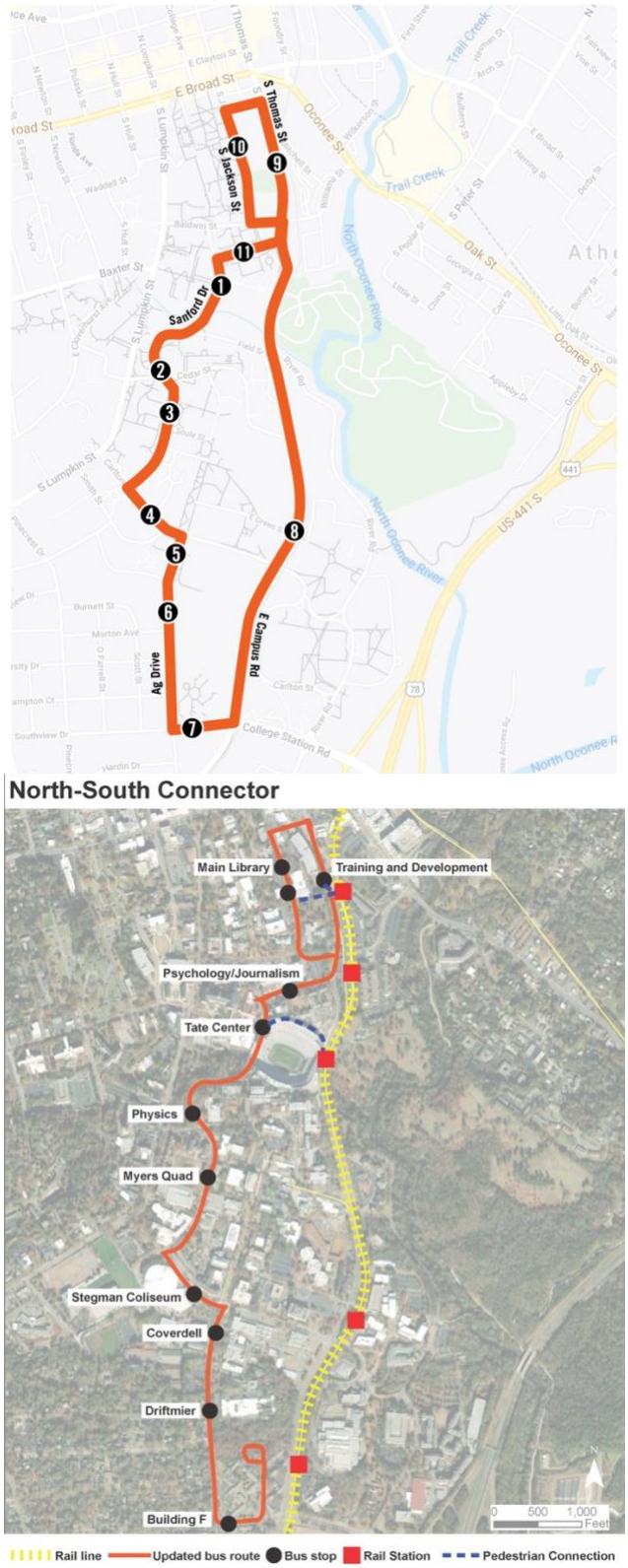


Figure 25: Map showing the existing route (top) and the rerouting of the North South Connector UGA Transit route (bottom)

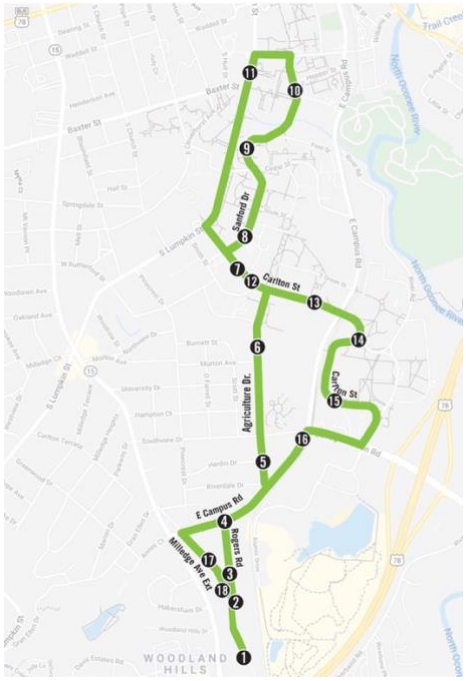


Figure 26: Map showing the existing route (top) and the rerouting of the Bulldog Housing UGA Transit route (bottom)

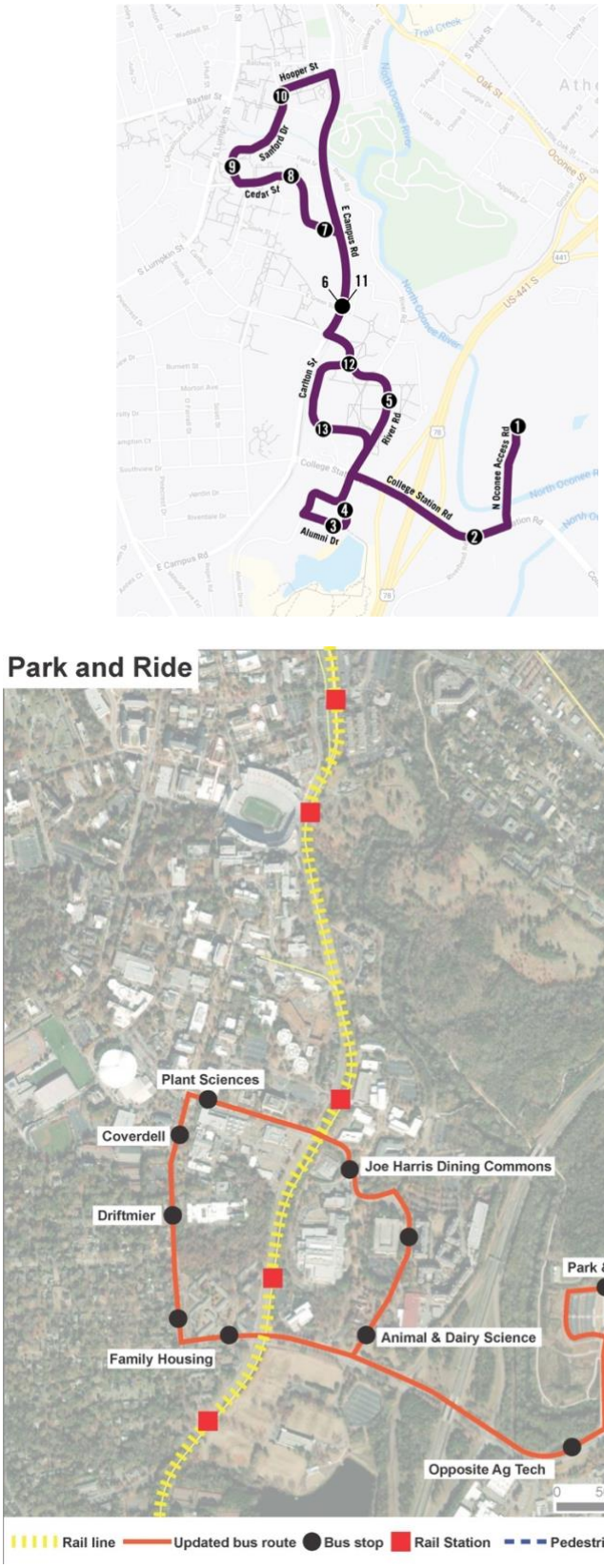


Figure 27: Map showing the existing route (top) and the rerouting of the Park and Ride UGA Transit route (bottom)

7.3. Finance

This speculative research places institutions as the main stakeholder that is capable of catalyzing rail transit projects through their campuses. They are therefore, the primary generators of transit funding as well. In the case of the University of Georgia there is already a transit agency that operates buses on campus and collects a transportation fee from students each semester ($121 annually per student in 2021). Paying this mandatory fee, allows students and others (within and outside the campus) to ride the campus transit buses throughout the year without having to pay each time they board the bus. When rail transit is added as an option in the future and the number of buses are reduced to complement the rail commute, a portion of this transportation fee can be transferred toward the operation and maintenance costs of rail transit.

- Tax Increment Financing/Tax Allocation Districts (also includes private development on campus fringes, land rents, downtown tax allocation districts etc.)
- Capital funding
- Transit fees for operation and maintenance
- State/Federal appropriation
- The UGA Athletic Association (sports venues like Sanford Stadium with a seating capacity of 94,000 spectators)

In the next chapter, the author will explain the transferability of this research on to other institutional campuses.

7.4. Transferability of Research to Other Institutions

In the previous chapter, we applied the criteria established from the four case studies in an urban context to an institutional context (University of Georgia). In the introduction, the author defined institutions "as systems that consist of one decision-making body and a central operation and collection structure and have a physical presence."

This definition of institutions encompasses more than just educational campuses. It can include health campuses, large information technology (IT) parks and other commercial and recreational and military campuses as well (although military campuses are the most autonomous institutions and may require a different approach). As mentioned earlier in this research, institutions can be considered as fully functioning urban systems. Therefore, just like the criteria and their thresholds were applied to UGA, they can be applied to other institutions with a captive ridership as well.

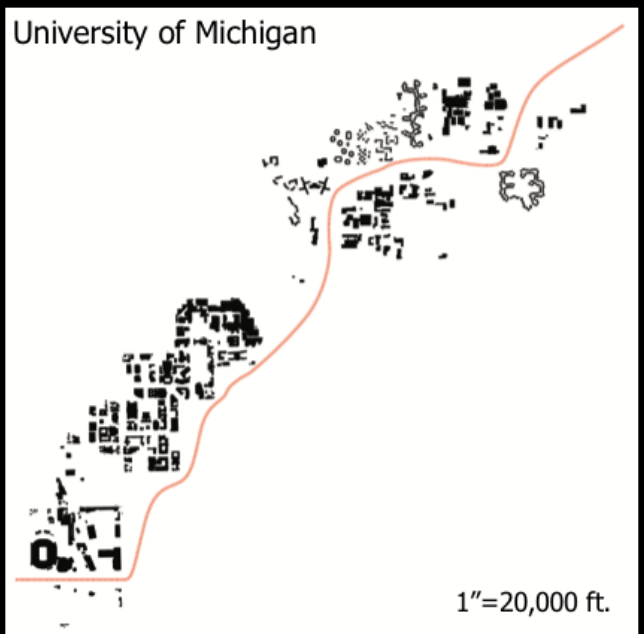
This chapter includes figure grounds of the following institutional campuses:

- University of Michigan, Ann Arbor, MI
- Penn State University, University Park, PA
- Texas A & M University, College Station, TX
- Emory-Center for Disease Control campus, Atlanta (GA)
- National Institute of Health, Bethesda, MD
- University of Texas Southwestern Medical Center, Dallas, TX

Each figure ground diagram shows a rail line passing through the campus. These rail lines are hypothetical and are just shown to indicate the similarities of all these campuses, in

terms of their institutional settings and capabilities for initiating rail transit. The goal of the figure grounds is to show the scale of all the institutions and how each of them can plan for rail transit through their boundaries in the future. The evaluative criteria established through this research can be applied to other campuses as well.

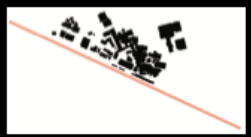
Transferability



Transferability


Emory-CDC


NIH


UT Southern Med Center

CHAPTER 8

CONCLUSION

In conclusion, I will answer all the research questions listed earlier in this document.

8.1. Can an institution with captive ridership serve as a catalyst for the establishment of a rail transit system?

Yes, institutions with captive ridership can launch rail transit systems within their boundaries as long as they are able to satisfy the criteria established in this research according to their context, requirements and expectations from rail. The very reason for adopting a qualitative approach was to give institutions the flexibility to input their facts and figures in the criteria.

8.1.1. Sub-questions

- **What are the factors/criteria that caused cities to pursue rail transit as a transportation alternative?**

  This question is answered in chapter 5 and 6. The criteria are a direct result from the author's conversations with transit officials and offer a solution when institutions will have to decide between rail and other forms of transit (rail does not have to be the answer/solution every time for every institution).

- **Once the cities decided to pursue rail transit, what are the thresholds they achieved/planned to achieve to ensure the viability of rail transit?**

  This research lists the thresholds not only for the four case studies, but also for the rail line passing through the UGA campus in Athens, GA. Although these thresholds may not be universal or applicable to all institutions, it provides them with a quantitative component to compare with their own numbers. Other institutions may accept these thresholds or create new ones, based on their rail contexts sand narratives.

- **Once established, are those evaluative criteria and their thresholds be equivalent to those of an institution such as the University of Georgia?**

  Yes, this research has clearly shown that the conditions and numbers that already exist for the rail line (that passes through the UGA campus in Athens, GA) are comparable (the determinacy is in over the established thresholds) to other urban settings (similar to the four case study cities). Due to the lack of research in the realm of catalyzing transit within institutions, this research takes an in-depth look at the urban context and applies it to the institutional context. The values for the criteria established in this research not only work for establishing the need for rail transit within UGA, but also emphasizes the role of an institution like the University of Georgia in launching that rail transit. Therefore, UGA has the answers it needs to start considering this rail line as an alternative transportation option in the future.

From this research it can be seen that given the scale and impact of institutions in our towns and cities, they can be considered as fully functioning urban systems. Moreover, the criteria suited for urban transportation can be applied to institutions in order to help them decide their choice of transit mode. Following are the learnings from the establishment and application of criteria for the initiation of rail transit within an institution:

- There needs to be strong policy and leadership support for rail transit
- The user community can provide strong grassroot advocacy by initiating discussions, debates, recruitments and knowledge creation around rail transit
- The initial length of the rail depends heavily on land acquisition
- It is always an advantage if the ridership generators for rail are already present before planning.
- The densities around stations need to be medium to high and efforts need to be made in order to capture the maximum number of passengers on to rail transit
- The multimodal nature of rail stations is crucial to streamline multiple modes of transportation to handle the transportation demand. All modes of transit need to complement each other and work together in coordination.

Specific to the University of Georgia, this research shows that the UGA can have a rail system passing through its campus provided the bus routes act as feeders to rail transit. The UGA campus and the location of land-uses and rail present an opportunity for future rail planning. As we learnt from the case studies, it will be very helpful if rail transit is included in the campus and city's comprehensive planning. In order for rail transit to become a reality, UGA will have to

take the initiative and be the main stakeholder in rail planning and design. Once the initial rail line works well, the regional expansion of the system (including connection to the Greenfield high speed route) will be manageable.

8.2. Next steps

One of the first steps would be to summarize this dissertation research and start disseminating the shorter version of the study with various stakeholders within UGA. It would also be worth suggesting to UGA to appoint a transportation company to study the rail alternative in more detail, using this dissertation as the groundwork. Following are some of the steps that can be suggested:

- Disseminate a summarized version of this dissertation
- Generate railroad exposure: Restored rail cars can be brought to the Sanford Stadium for people to see, especially during game day weekends
- Identify primary stakeholders within UGA who would be interested in the rail project (for example, possibly the UGA Athletic Association)
- Once the rail line/track is restored, a single line service along the 5.5-mile route can be started (frequency of trains just enough to gain public attention)
- Once the single-track line gains popularity and momentum, a second track can be phased in with rail transit rolling stock (two lines: northbound and southbound)

This speculative research has provided some important initial answers for the development of rail transit within UGA and institutions in general. The hope is that we will start thinking about

provision of rail transit from a different point of view and justifying rail in urban institutions that have the captive ridership to support it.

REFERENCES

Baldwin, Davarian L. “In the Shadow of the Ivory Tower: How Universities are Plundering Our Cities.” New York: Bold Type Books, 2021.

Bannister, David. “Transport and Urban Development.” London: E & FN Spon, 1995.

Belzer, Dena and Autler, Gerald. “Transit Oriented Development: Moving from Rhetoric to Reality.” The Brookings Institution and the Great American Station Foundation (June 2002). https://community-wealth.org/sites/clone.community-wealth.org/files/downloads/report-belzer.pdf

Bianco, Martha J. “Technological Innovation and the Rise and Fall of Urban Mass Transit”. Journal of Urban History, 25, no. 3 (March 1999): 348-378. https://doi.org/10.1177/009614429902500303

Black, J., A., Paez, A. and Suthanaya, P. A. “Sustainable Urban Transportation: Performance Indicators and Some Analytical Approaches.” Journal of Urban Planning and Development, 128, no. 4 (December 2002). https://doi.org/10.1061/(ASCE)0733-9488(2002)128:4(184)

Bond, Alex and Steiner, Ruth, L. “Sustainable Campus Transportation Through Transit Partnership and Transportation Demand Management: A Case Study from the University of Florida.” Berkeley Planning Journal, 19, no. 1 (2006). https://escholarship.org/uc/item/04b7c73h

Brown, Jeffrey, Hess, Daniel and Shoup, Donald. “Fare-Free Public Transit at Universities: An Evaluation.” Journal of Planning and Education Research, 23 (2003): 69-82. https://journals.sagepub.com/doi/pdf/10.1177/0739456X03255430

Bruijn, Hans, De and Veeneman, Wijnand. “Decision-Making for Light Rail.” Transport Research Part A: Policy and Practice, 43, no. 4 (May 2009): 349-359. https://doi.org/10.1016/j.tra.2008.11.003

Cervero, Robert. "Growing Smart by Linking Transportation and Land Use: Perspectives from California." Built Environment (1978-) 29, no. 1 (2003): 66-78. http://www.jstor.org/stable/23288299.

Cervero, Robert. “The Transit Metropolis: A Global Enquiry.” Washington DC: Island Press, 1998.

Cervero, Robert. “Journal Report: Light Rail Transit and Urban Development”. Journal of the American Planning Association, 50, no. 2 (November 2007): 133-147. https://doi.org/10.1080/01944368408977170

Cervero, Robert, Guerra, Erick and Al, Stefan. “Beyond Mobility: Planning Cities for People and Places.” Washington DC: Island Press, 2017.

Cervero, Robert, Bernick, Michael and Gilbert Jill. “Market Opportunities to Transit-Based Development in California.” The University of California Transportation Center (1994). https://escholarship.org/uc/item/2c01z5hw

Champion, A., G. “A Changing Demographic Regime and Evolving Polycentric Urban Regions: Consequences for the Size, Composition and Distribution of City Populations.” Urban Studies, 38, no. 4 (2001): 657-677. https://journals.sagepub.com/doi/pdf/10.1080/00420980120035277

Dilger, Robert Jay. “ISTEA: A New Direction for Transport Policy.” Publius: The State of the American Federalism, 28, no. 3 (Summer 1992): 67-78. https://www.jstor.org/stable/3330252

Dittmar, Hank and Ohland, Gloria. “The New Transit Town: Best Practices in Transit-Oriented Development.” Washington, D.C.: Island Press, 2004.

Divall, Colin and Bond, Winstan. “Suburbanizing the Masses: Public Transport and Development in Historical Perspective.” New York: Routledge, 2003.

Educational Facilities Laboratories. “Campus and Community”. 1980.

Ehrenhalt, Alan. “The Great Inversion and the future of the American City.” New York: Random House Inc., 2012.

Elmer, Vicki and Leigland, Adam. “Infrastructure Planning and Finance: A Smart and Sustainable Guide for Local Practitioners.” New York: Routledge, 2014.

Florax, Raymond. “The University: A Regional Booster?”. England: Avebury, 1992.

Freilich, Robert, H. “The Land-Use Implications of Transit Oriented Development: Controlling the Demand Side of Transportation Congestion and Urban Sprawl.” Urban Lawyer 30, no. 3 (Summer 1998): 547-572. https://www.jstor.org/stable/27895129

Grengs, Joe. “The Abandoned Social Goals of Public Transit in the Neoliberal City of the USA.”. City, 9:1, (October 2010): 51-66. https://doi.org/10.1080/13604810500050161

Giuliano, Genevieve. “Land Use Policy and Transportation: Why We Won’t Get There from Here.” Transportation Research Board Circular, (August 1997). https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.201.1651&rep=rep1&type=pdf

Hanson, Susan and Giuliano, Genevieve. “The Geography of Urban Transportation.” New York: The Guilford Press, 2017.

Haar, Sharon. “The City As Campus: Urbanism and Higher Education in Chicago.” Minneapolis: University of Minnesota Press, 2011.

Jacobson, Justin, and Ann Forsyth. "Seven American TODs: Good Practices for Urban Design in Transit-Oriented Development Projects." Journal of Transport and Land Use 1, no. 2 (2008): 51-88. http://www.jstor.org/stable/26201614.

Jescu-Saftescu, Corina. “A Central Problem of Contemporary Philosophy: Institutional Facts. John Searle’s Point of View”. Procedia: Social and Behavioral Sciences, 71 (2013): 148-153. https://www.sciencedirect.com/

Litman, Todd. “Affordable-Accessible Housing in a Dynamic City: Why and How to Increase Affordable Housing in Accessible Neighborhoods.” Victoria Transport Policy Institute, (June 2021). https://vtpi.org/aff_acc_hou.pdf

Marshall, Stephen. “Urban Pattern Specification.” Institute of Community Studies, (January 2005). https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.115.5605&rep=rep1&type=pdf

Mattioli, Giulio, Roberts, Cameron, Steinberger, Julia K. and Brown, Andrew. “The Political Economy of Car Dependence: A Systems Provision Approach”. Energy Research and Social Science, 66 (February 2020): 101486. https://doi.org/10.1016/j.erss.2020.101486.

Mendenez, Aurelio. “Estimating Capital and Operating Costs in Urban Transportation Planning.” Westport, CT: Praeger Publishers, 1993.

Miller, John, S. and Hoel, Lester, A. “ The “Smart Growth” Debate: Best Practices for Urban Transportation Planning.” Socio-Economic Planning Sciences, 36 (2002): 1-24. https://doi.org/10.1016/S0038-0121(01)00017-9

Miller, J., H. “Transit Cooperative Research Program Synthesis: Transportation on College and University Campuses.” Transportation Research Board, (2001). http://onlinepubs.trb.org/onlinepubs/tcrp/tsyn39.pdf

Murphy, Thomas P. “Universities in the Urban Crisis.” New York: Dunellen Publishing Company, Inc, 1975.

National Academy of Sciences. “Light Rail Transit: Planning, Design and Implementation.” Washington D.C.: 1982.

Newman, Peter and Kenworthy, Jeff. “The Ten Myths of Automobile Dependence.” World Transport Policy & Practice, 6:1 (2000): 15-25. https://ecoplan.org/library/wt6-1.pdf#page=15

Nordhal, Darrin. “My Kind of Transit: Rethinking Public Transportation in America”. China: University of Chicago Press, 2008.

Ozturk, Onur and Patrick, Jonathan. “An Optimization Model for Freight Transport Using Urban Rail Transit.” European Journal of Operational Research, 267, no. 3 (June 2018): 1110-1121. https://doi.org/10.1016/j.ejor.2017.12.010

Pashigian, Peter, B. “Consequences and Causes of Public Ownership of Urban Transit Facilities.” Journal of Political Economy, 84, no. 6 (December 1976). https://doi.org/10.1086/260510

Phang, Sock-Yong. “Urban Rail Transit PPPs: Survey and Risk Assessment of Recent Strategies.” Transport Policy, 14, no. 3 (May 2007): 214-231. https://doi.org/10.1016/j.tranpol.2007.02.001

Pushkarev, Boris, S. Zupan, Jeffrey, M. and Cumella, Robert, S. “Urban Rail in America: An exploration of Criteria for Fixed Guideway Transit.”

Rodrigue, Jean-Paul. “The Geography of Transport Systems.” New York: Routledge, 2020.

Saif, Muhammad Atiullah, Zefreh, Muhammad Maghrour and Torok, Adam. “Public Transport Accessibility: A Literature Review”. Periodica Polytechnica Transportation Engineering, (February 2018). https://doi.org/10.3311/PPtr.12072

Schiller, Preston, L. and Kenworthy, Jeffrey, R. “An Introduction to Sustainable Transportation: Policy, Planning and Implementation.” Washington DC: Earthscan, 2010.

Sciara, Gian-Claudia. “Metropolitan Transportation Planning: Lessons from the Past, Institutions for the Future.” Journal of the American Planning Association, 83, no. 3 (Summer 2017). https://www.tandfonline.com/doi/full/10.1080/01944363.2017.1322526

Suzuki, Hiroaki, Cervero, Robert and Luchi, Kanako. “Transforming Cities with Transit: Transit and Land-Use Integration for Sustainable Urban Development.” Washington DC: The World Bank, 2013.

Ville, Helminen, Hannu, Rita, Mika, Ristimaki and Panu, Kontio. “Commuting to the Center in Different Urban Structures.” Environment and Planning B: Planning and Design, 39 (May 2011): 247-261. https://journals.sagepub.com/doi/abs/10.1068/b36004

Waddell, Paul, Ulfarsson, Gudmundur, F., Franklin, Joel, P. and Lobb, John. “Incorporating Land Use in Metropolitan Transportation Planning.” Transportation Research Part A, 41 (2007): 382-410. https://doi.org/10.1016/j.tra.2006.09.008

Weicher, John. C. “Private Innovations in Public Transit.” Washington, D.C.: American Enterprise Institute for Public Policy Research, 1988.

Wells, Alan Frank. “Social Institutions.” London: Heinemann Educational, 1970.

Williams, Katie. “Spatial Planning, Urban Form and Sustainable Transport.” Burlington, VT: Ashgate Publishing Limited, 2005.

Wiewel, Wim and Perry, David C. “The University as Urban Developer: Case Studies and Analysis.” Lincoln Institute of Land Policy. Cambridge, Massachusetts. 2005.

Wiewel, Wim and Perry, David C. “Global Universities and Urban Development: Case Studies and Analysis.” Lincoln Institute of Land Policy. Cambridge, Massachusetts. 2008.

Yago, Glenn. “The Decline of Transit: Urban Transportation in German and U.S. Cities, 1900-1970.” New York: Cambridge University Press, 1984.