IMPACT OF TRANSIT-ORIENTED DEVELOPMENTS ON HOUSING AND TRANSPORTATION AFFORDABILITY: APPLYING CASE STUDY RESULTS AND PREVIOUS KNOWLEDGE TO GAINESVILLE IN 2060

By

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LIST OF ABBREVIATIONS

BART	Bay Area Rapid Transit
BEBR	Bureau of Economic and Business Research
CEDA	Community and Economic Development Agency
DART	Dallas Area Rapid Transit
DOT	Department of Transportation
MTPO	Metropolitan Transportation Planning Organization
NFRMC	North Florida Regional Medical Center
OHA	Oakland Housing Authority
TOD	Transit-Oriented Development
UF	University of Florida
US	United States

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Using a new definition of affordability as a function of both housing and transportation costs, this thesis uses an economic model to determine how transit-oriented developments around rail systems impact the combined affordability for residents. Pleasant Hill Station, along the Bay Area Rapid Transit line in the Bay Area of California, and Mockingbird Station, along the Dallas Area Rapid Transit line in Dallas, are used as the two case studies for this report. Monetary cost models for each case study take into account driving distances to central business districts, rent premiums around TODs, parking and gasoline costs, automobile ownership costs, and transit costs for a series of commuters in different locations to determine the most equitable result.

The outcome of these case studies, combined with previous research, then became the basis for testing the affordability of the Gainesville 2060 Long Range Transportation light rail alternative proposed by Gainesville Metropolitan Transportation Planning Organization Director Marlie Sanderson. Affordability within Gainesville was measured by balancing rent premiums with the reduction in automobile ownership and resulted in a significant net savings for residents within TODs. A hypothetical rail line traversing along Newberry Road, University Avenue, and Waldo Road containing ten stops and seven planned TODs was created to determine the percentage of the population affected. Though many of the variables within the model may

change over time, the results of this thesis challenge the assertion that costs increase for citizens upon the construction of a rail transportation system when affordability is defined as a measure of combined housing and transportation costs.

Generally, research is lacking regarding the area-wide affect that recent light rail systems have had on rents and property values, and further research in this area would help strengthen some of the assumptions within this model. Specifically relating to the Gainesville in 2060 scenario, transportation modeling software should be used to analyze the potential ridership along the proposed light rail line, and cost estimates should be conducted to determine the amount of funding required to complete such a project.

CHAPTER 1
INTRODUCTION

"If a city has rapid transportation, it will hold together and renew itself. If it does not have a means of rapid travel, it will decentralize and the obsolete will be forsaken and left to fester and blight" (Sidney Waldron, Detroit Rapid Transit Commission: March 23, 1944). Much irony exists in the previous statement, from the city to the year, and unfortunately Mr. Waldron's statement was all too prophetic. Since the end of World War II, a massive shift has occurred in the way cities develop. The United States economy has transitioned from a blue collar industrial economy to a service economy, diversity in the workplace has increased as both men and women began working full-time jobs, and the automobile has become the preferred, if not only, means of transportation. In the process, many wealthy citizens have moved to the suburbs, leaving the poor behind in the inner-cities. The suburban form that has emerged differs greatly from the traditional form by favoring large lot sizes and controlled access neighborhoods that distribute traffic onto high capacity roads or arterials over town-centered developments. Accommodation of this traffic has become one of the main functions of community policy and planning, and in the process a lack of affordable housing has become an increasing problem (Eisenberg, 2004).

With cities sprawling and commute times lengthening, the search for affordable housing cannot be discussed without taking into account the transportation costs associated with getting from this housing to and from work, commercial districts, and other activities. Currently, transportation is the second highest household expenditure behind housing in the United States, and it combines to account for over 50% of the budget for the average American family (Canby, 2003). To counteract this trend, planning departments around the country have begun to explore the use of transit oriented developments (TODs). These developments attempt to concentrate a mix of residential and commercial uses around a transit station, and offer an opportunity for the

provision of medium to high density affordable housing and a reduction in transportation costs through improved accessibility and mobility.

The Gainesville Metropolitan Transportation Planning Organization (MTPO) recently announced plans for testing various alternative directions for long range transportation planning in the area in the next 50 years using the future population projections developed by the 1000 Friends of Florida. The four alternatives named by MTPO director Marlie Sanderson at the meeting of that commission on October, 11, 2007 were (1) a western grid network, (2) a circular beltway around the city, (3) a light rail system along major arterials, or (4) a bus rapid transit system along major arterials.

A light rail system should not be considered out of the realm of possibilities for a City the size of Gainesville in the next fifty years, as cities such as Norfolk, Virginia and others with populations under 250,000 have light rail systems either in the construction or planning stages. Though the current size of Gainesville is relatively small (estimated population of 110,000 in 2006), the City has nearly six times more riders per capita on its RTS bus system than central Florida companion Orlando, (Central Florida, 2007; Gainesville Regional, 2007) while nearly matching the ridership of Hillsborough Counties' HART system,[1] which serves an urban area of over 2 million and recently opened a downtown streetcar line (Hillsborough Area, 2007). Gainesville presents a unique opportunity for a city of its size due to the large number of students and faculty commuting to a single location with restricted parking. Students are typically more willing to take transit than the population as a whole, and many make several trips to and from class during the day due to gaps between classes.

[1] Comparing annual ridership for the 2006-2007 year, Gainesville's RTS system had 8.9 million riders while Hillsborough Counties' HART system had 10.6 million riders (Gainesville Regional, 2007; Hillsborough Area, 2007).

The first part of this thesis will attempt to quantify the effectiveness of current transit-oriented developments at reducing the combined housing and transportation costs for low and middle income families through case studies of two TODs: Mockingbird Station in Dallas, Texas and Pleasant Hill Station in the Bay Area of Northern California. The second part of this thesis will combine previous research on TODs with the findings of the two case studies, and apply it to Alternative Three of the 2060 long range transportation plan for the Gainesville Area presented at the October 11th Meeting of the Gainesville Metropolitan Transportation Planning Board. The final verdict of this thesis will answer whether an argument can be made for or against the light rail alternative in Gainesville on the grounds that it will increase combined housing and transportation affordability for low and middle income households. The result will include the percentage of the population affected and the extent, along with a critical analysis of the results.

A key to the success of the American democracy is an informed citizenry. In the absence of empirical studies with definitive conclusions, special interest groups and ideologues, more interested in a specific agenda than the public good, have free reign over the debate and much greater leeway in affecting public opinion. In cities from California to Florida the merits of TOD have been thoroughly debated, but little research has been undertaken specifically intended to determine the affordability, in terms of both housing and transportation, of living within these developments. The final result of this thesis will hopefully provide empirical data to better inform the public regarding the combined housing and transportation costs experienced by residents of TODs, and serve to dispel many of the myths and rumors regarding TODs and their effect on affordability.

CHAPTER 2
LITERATURE REVIEW

Introduction

While little literature exists specifically connecting transit-oriented developments (TODs) with their effect on combined housing and transportation costs, a large body of research exists regarding each part of the research question. This literature review will take a comprehensive approach by summing the individual parts of research to provide an extensive background for the subsequent analysis on the topic.

The conventional way to view locational affordability is principally through housing costs, so this area will be examined initially. The connection between housing and transportation costs will then be established to develop an overall measure of affordability as a combination of the two. Upon establishing combined housing and transportation affordability as the problem, TODs will be examined as a possible solution. This examination will include a background on the definition, design, benefits, challenges, and criticisms of TODs. Finally, the feasibility of a light rail system in a city the size of Gainesville will be investigated.

Affordable Housing

Definition

The threshold for affordable housing is commonly defined as 30% of family income. Housing stock within a given area is typically defined as affordable when the annual rent total is less than 30% of the median income. Likewise, families spending over 30% of their pre-tax family income are deemed to have an excessive housing cost burden. Using the later criterion, nearly 25% of all homeowners and 40% of all renters surveyed nationwide have an excessive housing cost burden, with these burdens concentrated among low income families (Schwartz, 2006). In the City of Gainesville, possibly due to the large percentage of college students, the

numbers are more polarizing as only 20.2% of homeowners, but 50.4% of renters' surveyed pay more than 30% of their annual income on housing (Alachua County, 2003).

Why is This a Problem?

As regulation has increased the overall quality of the housing stock, affordability has become an increasing problem throughout the United States. Over the past several decades, rents have increased faster than the incomes of renters, leading to an increasing percentage of the population without access to housing, not because of a lack of units, but rather a lack of appropriately priced units (Schwartz, 2006). Government regulation of the housing market initially sought to improve the conditions in the inner city slums of the early 20th century. Overcrowding, unsanitary waste disposal, fire-prone and structurally deficient buildings, immoral behavior, and political unrest were the chief deficiencies of the tenement housing and the environments they created (Hall, 2002). Studies confirming that the living conditions expedited the spread of disease combined with both journalistic works and the newly invented photographs convinced city commissions to take action. Regulations were adopted by local, and later the federal government, increasing the size and quality, while decreasing the density of housing that could be provided (Schwartz, 2006). In the second half of the 20th century, in order to protect property values, suburban land use regulations began to segregate housing types, further limit density, and increase lot sizes through setback requirements, severely hampering the ability of the private market to provide affordable housing. Given the positive stigma and profitability of this type of housing and neighborhood development, it remains unclear whether the removal of these regulations would increase the amount of affordable housing (Schwartz, 2006).

From a units perspective, the lack of affordable housing likely results from both the reduction in federally subsidized housing stock and the inability of the private market to profit

from creating affordable housing. Visible failures of public housing projects during the 1950s and 1960s combined with a growing public sentiment for lower taxes and smaller government have decreased the percentage of units provided by the government over the last several decades (Schwartz, 2006). Many of the housing projects built during the era of urban renewal have been torn down for smaller-unit developments, while the displaced units have not been re-created elsewhere.

With vouchers increasing to over 54% of HUD's budget in 2004 (Schwartz, 2004: 176), the private market has become the chief mechanism for providing both subsidized and unsubsidized housing to low and middle income families. As rents increase, governments must pay more and more for each voucher, placing increased importance on the private market to provide affordable units. If funding doesn't increase proportionately with rents, fewer families can be provided with vouchers, and thus affordable housing. For low income families who don't qualify for vouchers, the private market is the only alternative – and an ever worsening alternative at that. During the 1990's the number of units renting for under $400 fell by 13%, and the number of units considered affordable to renters making below 30% of area median income fell by 19% (Schwartz, 2006: 34). Schwartz (2006) describes the difficulty of the private market in supplying affordable housing:

> The rents collected from affordable housing affordable to the lowest income households are often simply too low to cover the cost of maintenance, upkeep, debt service, and taxes, to say nothing of profit for the investors. As a result, almost all new unsubsidized rental housing is built for upscale markets. Owners of the affordable low-income housing that does exist are all too frequently left with two choices: gradually disinvest until the property becomes uninhabitable or reposition the property for higher income tenants (pg. 36).

In recent years local, state, and the federal government have searched for new methods of providing and promoting affordable housing to low and middle income families, but no solution has proven effective in all circumstances or without drawbacks and serious political opposition.

Besides vouchers and housing units, which directly address the problem, one new tool which has become increasing used by local governments is inclusionary zoning. Inclusionary zoning is defined by Wilson (1994) as "zoning ordinances or policies that either tie development approval to, or create regulatory incentives for, the provision of low to moderate income housing as part of a proposed development" (p. 17). While inclusionary zoning may provide affordable housing at little or no cost to local governments, create income-integrated communities, and reduce sprawl, some critics argue that it unfairly taxes developers, removes the "best" of the poor from their communities, and encourages unsustainable development (Galley and Burchell, 2000).

Local Affordability

Upon investigating the housing elements of the comprehensive plans of both Alachua County and the City of Gainesville, the two jurisdictions do not appear to recognize a significant affordable housing problem in either case, and only a portion of each element is dedicated to this topic, with neither employing aggressive strategies to address the problem. This complacency may be due to the large amount of generally wealthy, co-dependent college students who make up a substantial portion of the population. The statistics however, point to an existing problem for low income families, as 12,184 of the 39,206 households surveyed in Alachua County in 1999, earned less than $10,000 per year and over 75% of these households paid over 30% of their income on housing (Alachua County, 2003). The abundance of available land in western Gainesville and Alachua County will likely mean that the problem of affordable housing may not become pronounced for several decades. History has proven though, that planning for this issue must begin ahead of time, because upon buildout, creating affordable housing as infill housing become much more difficult, both politically and economically.

Housing and Transportation Connection

Evidence

Over the years, numerous models have been created that have attempted to quantify which factors have the greatest effect on housing prices. A model of the San Francisco Bay area found that commonly believed location factors such as proximity to a land-use mix, sales and service jobs, and parks and open space were found to have little correlation with housing prices. The one factor that had the greatest effect was the proximity to the central business district, illustrating the significant role that transportation plays in determining the cost of housing (Kockelman, 1997). This proximity to the central business district is such a significant indicator due to the value that residents place on time, which was estimated by the same model as approximately "$5/hr across all adult traveler trip types (in 1989 dollars)" (Kockelman, 1997). An earlier study of the San Francisco Bay Area concluded that the transportation cost savings for residents of Nob Hill, a neighborhood adjacent to the central businesses district, over those of San Ramon, an East Bay suburb lacking regional transit access, were around $6,000 a year due to an "efficient location" (Holtzclaw, 1994).

Due to the direct relationship between transportation and housing, one cannot begin to discuss affordable housing without mentioning the combined housing and transportation costs. Unlike housing costs, which tend to fluctuate relative to the state of the market, the cost of transportation has continued to steadily rise over the last several decades before leveling off just shy of 20% of pre-tax income for the average American family. As of 2001, the two largest expenditures for the average American family were housing at 32.9% and transportation at 18.6% (Canby, 2003: 4). For a family living under the poverty line though, the percentage spent on transportation increases drastically to 39.1% (Canby, 2003: 4).

Before discussing methods to reduce transportation costs, one must attempt to understand the relationship between transportation costs and housing costs. It seems intuitive that if you reduce the cost of transportation, you will reduce the combined transportation and housing costs. Urban economic theory, however, challenges the transitive property of mathematics by claiming that rents will rise to offset the savings in transportation costs. This theory presumes that, assuming all other factors are equal, the combined housing and transportation costs should be the same for all families, irrespective of location; therefore, someone living in the suburbs should be paying the same combined costs as someone living in the central business district. In reality though, this is not often the case due to market miscalculations and the self reinforcing effects of urban and suburban development (O'Sullivan, 2006).

History

Present day housing costs are best explained by examining the history of the modern American City. When cities began to swell following the industrial revolution, people chose to locate their homes close to work and their businesses close to their products and their labor market, because shorter distances meant lower transportation costs. This transportation cost for workers was mainly in the form of time, as nearly all residents walked to work, and the longer distance walked meant less time that they could be doing other tasks. As the mid-1800's approached, downtown cores of these walking cities began overflowing as development was unable to expand beyond 2 miles of City Hall due the slow speed of a pedestrian commute (Warner, 1962).

Between 1870 and 1900, the "whole scale and plan" of many industrialized metropolitan areas, such as Boston, was "entirely made over" with the advent of the electric streetcar (Warner, 1960: 22). The electric streetcar facilitated the development of suburbs extending as far as "ten miles" (Borchert, 2007) from the center of the city as upper and middle class citizens

"sympathizing with the rural ideal" (Warner, 1960: 14) escaped the tenement slums of the inner city. At the time it was a common belief among "street railway managers, real estate men, politicians, philanthropists, health officers, school teachers, and the middle class" in general that "open country surroundings and the small community" were the ideal locations to raise a family (Warner, 1960: 64). As lines extended and service frequency increased, development followed, rapidly filling the spaces along corridors parallel and within walking distance of the lines in a continuous strip from the center city.

Even with the suburban boom, cities of the late 1800s and early 1900s revolved around a dense urban core that housed most of the population and commercial businesses, while manufacturing plants located linearly along railroad lines and in proximity to ports within downtown areas (O'Sullivan, 2006). For the manufacturing industry, transportation was accomplished through the horse-drawn wagon for intracity transport and waterways or railroad lines for intercity transport. Offices chose to locate in a central location to be close to their labor market, and for the benefits of agglomeration economies, such as knowledge spillovers, sharing intermediate inputs, labor pooling, and labor matching (O'Sullivan, 2006).[2]

These patterns changed in the last half of the twentieth century though, mainly due to the advent of the automobile as the primary, and in some cases only, form of transportation for both people and goods. This change had the largest impact on the location of residents, as they were no longer restricted to either walking or public transportation. As post World War II incomes rose for many middle and upper class residents, they chose to move away from the small living spaces of the central business district and into the larger lot sizes of the suburbs. Urban

[2] Agglomeration economies are the economic forces which cause firms to locate close to one another. Within this realm, knowledge spillovers occur when businesses share ideas; sharing intermediate inputs occurs when clustering firms share suppliers decreasing productions and transportation costs; labor pooling occurs when the sharing of labor during the bust and boom cycle of local industries leads to a more stable labor market; and labor matching occurs when workers with more choices are better able to find the firm which better suits their skill set.

economics justifies this move because land is a normal good, and thus, as income increases, the desire for land increases (O'Sullivan, 2006). In theory the cost of this land should increase to account for the trade-off between the increased transportation cost and the desire for space (Boarnet and Crane, 2001: 34). This didn't hold true in reality though, as suburban land was under priced, and a move away from the central business district became a more financially sound decision (O'Sullivan, 2006).

Besides economics, there have been many other explanations for the suburban boom and the deterioration of the downtown that occurred in the mid to later half of the 20th century. Isenberg (2004) attributes it to four factors. First, the Great Depression for causing the demolition of large downtown structures to enable the construction of parking lots and one-story buildings, which reduced property taxes. Second, Urban Renewal for subsidizing the demolition of historic structures with intrinsically lower property values to make room for larger, more modern buildings and infrastructure. Third, racial riots, sit-ins, demonstrations and boycotts for causing many customers to fear shopping downtown. And finally, traffic congestion, for increasing the difficulty suburban shoppers faced in reaching downtown businesses (Isenberg, 2004). Peter Hall, a lifetime devotee of cities, gives four different reasons for the suburban boom. New roadways allowed development to take place in any direction. Zoning stabilized property values within monolithic residential developments. Government-guaranteed mortgages made it possible for those with lower incomes to buy housing, and the baby boom produced a surge in demand for family housing. Given that the roadways, zoning, and mortgages were in place in some form prior to the Second World War, Hall (2002) concludes that these three were facilitators, and the baby boom was the trigger for the flight from downtown (pg. 316).

The mass exodus from the central city has led to several reinforcing effects. With the majority of the population moving to the suburbs, the commercial service industry has followed in order to lower the transportation costs between themselves and their clients. As telecommunications technology has allowed the passage of information over large distances with ease, office firms began decoupling their operations into central and suburban locations to shorten the commute distance between their offices and the majority of their employees (O'Sullivan, 2006). These changes in the commercial sector have further encouraged residents to locate outside of the central city due to lower housing costs and lower transportation costs. Some other major effects and causes of the decreased desirability of downtowns include: a deteriorating housing stock, central city fiscal problems, increased intercity crime, and a lower quality education system (O'Sullivan, 2006). The combination of these factors has led to a development pattern of cities that favors the wealthy through reducing their housing costs by locating them far from the city, and reducing their transportation costs as businesses and services have located nearby in suburban locations. The poor, however, have been left in the inner city, far from services and jobs located in the suburbs.

Public Transportation

Formerly the principal means of suburban commutation, public transit is currently an afterthought as only 9% of residents in the 28 largest metropolitan areas used this form of transportation to get to work (Dawkins, Haas, and Sanchez, 2003: 64). From a time standpoint, public transportation is not as efficient a means of travel as the automobile. In the 28 largest metropolitan areas, the average commute time by automobile took 26.1 minutes and traveled 9.5 miles, while the average public transit commute traveled 7.7 miles in 45.9 minutes (Dawkins, Haas, and Sanchez, 2003). Even in the city of Los Angeles, which is infamous for congestion, the commute times on transit were still over 15 minutes longer than for automobiles, as was the

case in all 28 metros surveyed. This indicates that traffic congestion does not play a significant role in commute choice except along specific routes in which automotive traffic flow is significantly restricted while transit is not.[3]

While driving is the least time consuming way to commute, public transportation has proven to be the least costly method of transportation to and from work. The two cities with the lowest percentage of annual household costs spent on transportation, San Francisco, CA and New York, NY, also have the highest percentages of transit commuters (Dawkins, Haas, and Sanchez, 2003). McCann (2000) found a 3% decrease in annual transportation costs for households within communities with more diverse transportation systems. Monetarily, Canby (2003) places the cost of commuting on public transportation nationwide at between $800 and $1,500 per worker per year, whereas the average personal automobile commuter can spend this much on gas alone. The total cost of owning and operating a vehicle, which includes insurance, maintenance, fuel, and lease payments costs the average American over $6,000 per year (Canby, 2003: 5).

Given the lower costs, one would assume that most low-income families would choose not to own an automobile, and instead would take public transit to work, but most low-income families own vehicles. One reason for automobile ownership among economically distressed families is a lack of transit access. Less than half of all Americans live within a quarter mile of a transit stop (Canby, 2003). Another reason is the lack of transit connectivity. Many regional transit networks revolve around connecting suburban residential neighborhoods with office employment centers in the central business district, rather than connecting low-income

[3] An example of this would be where major rivers funnel traffic onto a few bridges leading to significant congestion while rail transit systems are given a dedicated right of way which allow them to travel unobstructed, such as the BART tunnel vs. the Bay Bridge between San Francisco and Oakland.

residential urban areas with suburban commercial service activity centers. A final reason is the presence of rent premiums near transit. Within the current marketplace, realtors and appraisers value land near transit at a higher value because of the increased accessibility and the presumed reduction in transportation costs. Rent premiums are consistent with the urban economics model that states that rents will rise to offset the savings in transportation costs. In some extreme cases rents have seen increases as large as 30% - 50% in areas near a transit station relative to those without transit connectivity (Cervero et. al., 2004: 166, 173).

Many studies have been conducted in an attempt to quantify the effect that proximity to public transit has on housing prices in different locations around the country. Cities that have noticed significant rent premiums near transit include Philadelphia (6.4%), Boston (6.7%), Portland (10.6%), San Diego (17%), Chicago (20%), and Dallas (24%) (Cervero et. al., 2004: 162). With bus routes ability to change freely, combined with a societal preference for rail transit over buses, no significant rent premiums are typically associated with traditional bus transportation (Pushkarev and Zupan, 1977). Thus, most studies have focused on three different types of fixed guide-way transportation: light rail, heavy rail, and commuter rail. The San Diego Coaster Commuter Rail noticed a 46.1% rent premium for condos and a 17% increase for single family homes (Cervero et. al., 2004: 166). The Bay Area Rapid Transit (BART) heavy rail line in Alameda County noticed sale prices rose by $2.39 for every meter closer to the BART (Cervero et. al., 2004: 173). A study of Orenco Station along the MAX light rail line in suburban Portland, Oregon found a 20% to 30% increase in rents in the area surrounding the station (Cervero et. al., 2004: 161).

While the previous research forms a near consensus that fixed guideway transportation investment yields an increase in property values around the stations and corridors, a limited body

of research also suggests that this increase in property value is redistributive rather than generative. Stated more clearly, current findings indicate that the overall value of land within a metropolitan area adding a rail system will remain the same because the rising price of land around transit will be offset by an equal and opposite reduction in land value elsewhere. This effect is demonstrated more generally by the Gauthier (1970) study that indicated that improvement in transportation may help some parts of the region while harming others. Particularly relating to transportation and residential property values, Mohring (1961) found that an increase in land value near a highway was balanced by relative decreases in other areas not served by the highway. Relating specifically to transit, Spengler (1930) concluded that new transit lines shift value, rather than create it. More recently, impact studies of the Bay Area Rapid Transit System (BART) found that while concentrated development occurred around many stations, municipalities without BART access received a similar increase in housing units as those areas with BART stations, demonstrating that the presence of BART merely concentrated inevitable local growth (Cervero and Landis, 1997). Using residential development as a surrogate measure of property values, this experience could be further used to indicate that residential rents are distributive rather than generative.[4]

Transit-Oriented Developments

Definition

In the last several decades, local governments and private investors have, for different reasons, begun to try to exploit the housing and transit connection through the use of transit-oriented developments (TODs). A loose definition of a TOD is a mix of uses at various densities centered around a transit stop. Hank Dittmar and Gloria Ohland (2004) argue that this acronym

[4] This statement also assumes a strong correlation between residential property values and rents.

should be reserved only for projects that achieve five goals: (1) homes are located within proximity to transit; (2) there is a rich mix of housing, shopping, dining, cultural, and recreation choices within walking distance of the transit stop; (3) there is a substantial increase in property values in and around the TOD; (4) the design of the development is attractive and pedestrian friendly; and finally (5) the station is designed to be flexible enough to respond to changes in lifestyle and demographics, as well as being forward thinking in terms of energy efficiency and innovation. Bernick and Cervero (1997) believe that successful transit oriented developments should accomplish six things: enhance mobility and environment, be pedestrian friendly, allow for suburban residents to live without an automobile, revitalize the surrounding neighborhood, increase public safety, and provide a space for public celebration.

By more inclusive definitions, the origins of TODs can be traced back to the early hub and spoke transit systems of the nineteenth century, which used cable cars, electric trolleys, and streetcars to transport residents from suburban areas along the spokes to the hub in the city center (Bernick and Cervero, 1997). In the modern era, the planning for, and constructing of, the new wave of transit-oriented developments coincided with the beginning of the New Urbanism movement in the late 1980s. The first TOD projects were implemented in the early 1990s in the metropolitan areas of the western cities of Portland, San Francisco, San Diego, and Los Angeles. Eastern cities such as Atlanta and Washington D.C. followed suit, and as of 2003, local metropolitan areas have classified over 100 station area developments as TODs nationwide (Cervero et. al., 2004: 16). These TODs accommodate transit uses that vary from light rail, to buses, and even ferries, though by Dittmar's definition, few, if any, of these new developments would be classified as TODs.[5] For the purposes of this thesis, a TOD will be defined as a high

[5] At the time of publishing, Dittmar believed that by his definition no TODs had been constructed in the modern era.

density, planned development with a mix of uses located within walking distance of a rail transit stop.

Design

The typical design elements of TODs are rooted in New Urbanist philosophy. The transit stop itself is the focal point of the development with intensities decreasing relative to the distance from the stop (Bernick and Cervero, 1997). The area around a stop, typically one-quarter to one-half a mile, is designed as a traditional neighborhood with a mixture of uses. From the transit stop outward, dense mixed-use commercial retail/apartment structures are followed by office-employment, civic buildings, and parks, followed by a less dense area of residential apartments, duplexes, and townhouses at a minimum density of 10 units/acre (Calthorpe, 1993). Buildings should be oriented to the street with minimal setbacks and signs and entrances should be designed at the scale of the individual rather than the automobile. TODs in more urban locations should contain a higher percentage of commercial employment and retail space and less housing than less urban and more neighborhood-oriented TODs (Calthorpe, 1993).

The transportation infrastructure for many TODs should be designed quite differently than the conventional automobile-oriented land use patterns that have developed over the past several decades. The mass transit line provides a second alternative to the arterial as the principal means of traveling to interurban employment and retail centers. This multi-modal approach shifts parking to a secondary role, removing it from the fronts of buildings and either hiding it underground, in building interiors, or at the rear of buildings, returning the street back to pedestrians. Unlike the conventional suburban street networks consisting of loops, cul-de-sacs and low connectivity, TODs should be designed with a modified, interconnected grid system that evenly distributes traffic out over a number of parallel streets, rather than onto a single principle

arterial. The grid system is oriented towards the transit stop and the central core of development to provide enhanced pedestrian and bicycle access (Calthorpe, 1993).

Benefits

Transit-oriented developments have the possibility of providing several benefits to their residents and the surrounding community. The first possible benefit is that these developments may become a catalyst for future development and economic growth. This theory involves three components: (1) high-density residential developments located near TODs are more profitable for developers than low-density development; (2) proximity to transit produces lower transportation costs for residents and businesses, allowing developers to increase rents; and (3) commercial development will cluster around TODs, similarly to the agglomeration of retail which occurs within a suburban mall. While these three outcomes are typical in transit oriented developments, studies have yet to determine if development occurs as redistribution from other parts of the city, or if the TOD generates new development. (Cervero et. al., 2004).

A second benefit of TODs is that they may create an environment for a diversity of housing choices. While diversity may occasionally occur naturally through market forces, government intervention is typically needed due to the efficiency found in creating large, monolithic housing developments.[6] The City of Austin, Texas has included in their TOD guidebook a requirement that a "housing affordability analysis and feasibility review that describes potential strategies for achieving specified affordable housing goals" (pg. 27) be conducted for every T.O.D (City of Austin, 2006). In one of the nation's leading cities for transit-oriented developments, Oakland, California, the Community and Economic Development

[6] Large housing developments with similar interior designs, exterior designs, and building materials increase profits due to the economic principle of economies of scale. Developing lands in smaller portions with more diversity of housing options typically generates less profit. This principal is illustrated in reality by the differing suburban development forms found in the older inner ring suburbs relative to the current trend in the outer ring.

Agency (CEDA) and the Oakland Housing Authority (OHA) recently began collaborating on several major projects to "rebuild large public housing developments, reduce density, create mixed income neighborhoods, and provide a mix of public housing, privately-owned assisted rental housing, and affordable homeownership" (City of Oakland, 2003: 2). A large number of these projects, the most ambitious of which being Coliseum Gardens, are TODs. A final tool for governments to provide affordable housing is conditional upon the provision of resources. Local governments and municipalities that have contributed public funds or lands for TODs may make future development contingent upon the developer making a percentage of the units affordable.

One final overall advantage of transit oriented developments, and most likely the principal justification for their use, rests on their ability to reduce urban sprawl. Over the last 50 years, commuting costs have risen sharply due to the prerequisite, in most US cities, of the automobile for commute. Inhabitants and surrounding residents of TODs who can live without an automobile can save between $4,000 and $5,000 a year on commuting costs (Canby, 2003). The cost burden also affects local governments as costs for providing infrastructure and services increase significantly in areas with sprawling land use patterns. Many more miles of drainage systems, roads, and utilities must be installed to cover a lower density population, and more schools, fire stations, and police stations must be built to cover a larger geographical area, forcing local governments to either raise taxes or face budget deficits.

In addition to monetary benefits, a reduction in urban sprawl can have a positive benefit on the environment through the reduction of automobile usage. Mobile sources (mainly cars and trucks) account for around 21% of the emissions of the 166 air toxins monitored by the EPA, and 40% of the 33 most dangerous toxins (Meyer & Miller, 2001). In general, mobile sources account for around 30% of emissions of both oxides of nitrogen and hydrocarbons - two gases

that in the presence of sunlight produce ozone, a known airway irritant, which combines with carbon dioxide to form the leading causes of global warming (Frumpkin, 2002: 203-205). In the auto-dependent sprawling metropolis of Atlanta, Georgia, the amount of nitrogen oxides and hydrocarbons derived from vehicles is substantially higher at 58% and 47% respectively (Frumpkin, 2002: 202). Several studies comparing strategies emphasizing TOD implementation over increasing highway capacity predict reductions in automobile travel by 20-25% (1000 Friends of Oregon, 1997; Cambridge Systematics, 1993). These predictions are supported by a Bailey (2007) study that determined that households located within three-quarters of a mile of high-quality transit service reduce their daily vehicle miles traveled by 26%. Besides reducing automobile usage, TODs have the added benefit of reducing automobile ownership. Ohland and Poticha (2006) analyzed the land use and transit impacts on vehicle ownership and found that good transit access reduced automobile ownership by 16% while good transit access combined with a mixed use environment reduced ownership by 87%. Reconnecting America (2004) further strengthens this conclusion through a nationwide study that found households within a half mile of fixed-guideway transit stations owned an average of 0.9 cars compared with an overall metropolitan average of 1.6 cars.

Urban sprawl has also been proven to reduce water quality and quantity. Sprawling land use patterns lead to an 11% increase in water runoff relative to undeveloped grassland leading to a depleted water table[7] and a shortage of groundwater in parts of the country, such as Florida, which derive their drinking water from this source (Frumpkin, 2002). Other studies have indicated that toxic chemicals and organic waste in surface water are present at higher levels in suburban development than in traditional developments, likely due to increased automobile

[7] Refers to subsurface water

usage and runoff (Frumpkin, 2002: 206). The highways connecting sprawling land uses are also a concern, as byproducts of highways such as metals and sodium have been shown in high concentrations in topsoil near highways, potentially leading to serious effects on ecosystem processes (Meyer & Miller, 2001).

Finally, reducing sprawl and returning to a more traditional, less auto-dependent land use pattern likely encourages physical fitness and improves the overall health of the community. A considerable body of research shows that low residential density, low employment density, and low connectivity are associated with less walking and bicycling (Frumpkin, 2002: 205). This sedentary lifestyle leads to higher rates of obesity and lower life expectancies (Frumpkin, 2002: 205). Using the 2001 National Household Travel Survey, Besser and Dannenberg (2005) concluded that Americans who use public transportation daily spend a median of 19 minutes walking to and from transit lines, and that 29% of these users achieve the recommended half hour of physical activity simply by walking between their origins and destinations and transit.

A RAND Corporation study found that "people who live in areas with a high degree of suburban sprawl are more likely to report chronic health problems such as high blood pressure, arthritis, headaches and breathing difficulties than people who live in less sprawling areas" (Sturm and Cohen, 2004). Urban sprawl also lends itself to auto-oriented strip development and their associated formula fast food restaurants serving foods high in calories, saturated fat and trans-fat, known causes of heart disease and even certain cancers (Schlosser, 2002). Listed perennially as one of the healthiest cities in the US,[8] San Francisco has enacted ordinances limiting the use of formula restaurants in order to promote economic vitality and healthier eating habits, while New York City has banned trans-fats from all restaurants. The irony of the current

[8] Listed as the 3rd Healthiest City by Sperling's Best Places (2007), and as the healthiest city for Men by Men's Health Magazine (2005).

situation is that one of the initial factors that lead people to flee the inner city during the post Civil War and post World War II periods was health, but currently, these sprawling suburbs appear to be substantially less healthy than the urban centers they surround.

Challenges

Given the benefits of transit-oriented developments, one would assume that their application would be more widespread. The fact remains, though, that several significant challenges face TODs in the 21st century. A survey of transit agencies, local governments, redevelopment agencies, metropolitan planning organizations, and state departments of transportation (DOT) found that the biggest obstacle to these developments were automobile-oriented land uses (Cervero et. al., 2004: 110). Problems with the built environment are difficult to tackle in this fashion because the problem is self-reinforcing; the problems with the built environment to which transit oriented developments respond, are the very problems preventing their use. The other main challenges listed in order of significance include: lack of lender interest, lack of local expertise, lack of market demand, and local zoning restrictions (Cervero et. al., 2004: 110). Of the other problems listed, many will solve themselves over time. Lack of lender interest and local expertise will increase over time as more projects are successfully completed, and local zoning restrictions will be altered more readily once more information is available to inform citizens and planners of the benefits of TODs. The lack of market demand may be due to poor advertisement or project design, because a 1998 survey of real estate homebuyers in Arizona, California, Colorado, Texas, and Florida found that 72% favored neighborhood development that clustered around a town center (Eisenberg, 2004). Market demand may also be increasing, as a recent study by the National Survey on Communities

concluded that "the weight of evidence from survey research – combined with home-buying trends – suggests a fundamental shift in favor of compact living" (Ewing, 2007: 52).[9]

The success or failure of many new light rail projects can be traced back to one main factor, whether the system significantly altered land use patterns. Cervero and Landis (1997) conducted a study of the Bay Area Rapid Transit (BART) system after 20 years, and concluded that even heavy rail transit could only minimally change regional land use patterns without strong public-policy initiatives. This realization has most likely lead to the application of transit oriented developments as a complimentary program to nearly all new major rail lines within the U.S. in the last decade.

The large-scale construction of TODs, however, may be influenced more heavily by market forces than any plan or proposal. The state of the local economy, in particular the housing market, will largely dictate whether TODs are built, even when a supportive regulatory framework exists.[10] Furthermore, an extended period of time with a depressed economy and little development/redevelopment around light rail stations may forever tarnish the rail line and their associated TODs as failures, and discourage redevelopment later down the line when the economy finally corrects itself. With the relative strength of the national housing market over the last several decades, this hypothesis may be difficult to prove, but the results in Buffalo, New York may support this theory. Buffalo completed a light rail system during the 1980s but due to

[9] The 2004 National Survey on Communities, conducted for Smart Growth America (a nonprofit advocacy group) and the National Association of Realtors, gave respondents a choice between communities labeled "A" and "B." Community A was described as having single-family houses on large lots, no sidewalks, shopping and schools located a few miles away, work commutes of 45 minutes or more, and no public transportation. In contrast, community B (the "smart growth" community) was characterized as having a mix of single-family and other housing, sidewalks, shopping and schools within walking distance, commutes of less than 45 minutes, and nearby public transportation.

[10] In Richmond California, local factors such as increased crime, a depressed local economy, and urban blight contributed to the failure of any major economic development efforts around the station (Cervero and Landis, 1997)

the depressed state of the economy, among other factors,[11] little development occurred around the rail line and ridership numbers have steadily decreased over the last decade.

Criticisms

Criticisms of passenger rail transportation and the larger transit-oriented development strategy are numerous. The most frequent criticisms involve cost, by claiming that automobiles and their infrastructure are more cost effective than public transportation and that buses are more cost effective than rail at moving large numbers of people. This cost logic is typically based on studies reflecting "reductionist analysis, which only considers a single objective" (Litman, 2007). In terms of passenger costs per mile, the three types of rail transportation (heavy, commuter, and light) are all significantly less than both automobile and bus transportation when vehicle costs, roadway costs, and parking costs are considered (APTA, 2002; Litman, 2003). Another criticism is that rail fails to attract new riders, and only shifts captive riders (riders with no other option) from buses to light rail. A study of Portland, OR over the last 10 years indicates to the contrary. As rail service has expanded, bus ridership has increased along with increased rail ridership (APTA, 2002). A final frequent criticism of rail is that its running speeds are considerably slower than automobiles making them unattractive to choice riders. On the whole, rail is significantly slower than automobiles when aggregating all trips; however, rail is not meant to function or compete with the automobile along all transportation corridors. During peak hours on major transportation corridors, rail speeds are very similar, if not faster, than automobile speeds due to congestion (Litman, 2007).

During the previously mentioned October 11th Gainesville MTPO meeting, Commissioner Braddy noted that he forwarded a study to the other members of the planning board conducted by

[11] Buffalo's light rail line also suffered from a lack of regional or citywide coordination of policies (Banister and Berechman, 2000).

the Brookings Institute and the Department of Economics at the University of California, Berkeley titled *On the Social Desirability of Urban Rail Transit Systems*. Commissioner Braddy explained that this study did "an analysis of light rail based on the social welfare", and that social welfare should be considered as one of the main factors when determining which transportation alternative to pursue for the future of Gainesville. Winston and Maheshri (2006) explain in the introduction of their report that the goal of the paper is to "estimate the contribution of each U.S. urban rail operation to social welfare based on the demand for and cost of its service" (pg. 363). While this thesis is not intended to be a referendum on their report, a disclaimer should be made before using this work as a reference. Using specific criteria such as the demand for, and cost of, service to measure such an infinitely broad category as social welfare is extremely misleading, analogous to judging an entire university or public policy institute on one misguided piece of literature. This document also makes no comparison of the social welfare of light rail with its alternative, the highway. A thorough research of highway construction over the last several decades would likely reveal that these forms of transportation are also heavily subsidized when considering the roadways themselves, their parking areas, and the indirect costs associated with their externalities such as accident risk and pollution (Litman, 2007). With these two significant flaws, the use of this document as a policy-making tool is weak at best.

Two criticisms specifically of TODs include that TODs are constructed largely on greenfield sites, creating the sprawl that they propose to reduce, and that they raise residential rents leading to gentrification. TODs are undoubtedly more effective and more suited as an infill strategy, but the difficulty of land acquisition and redevelopment poses a significant problem to both developers and local governments. With the concept of TODs unproven near the end of the twentieth century, the suburbs became a testing ground for these projects. While critics are

correct that this form of development is less sustainable than urban infill, TOD suburbs are far more sustainable than the conventional auto-dependent suburbs post 1950. Gentrification will be a continuing issue for the implementation of TODs as communities must balance the needs of current residents with the needs of the community as a whole. Most low-income and minority groups are not angered as much with being moved out of the substandard housing in which they reside, as they are with being forced out of their neighborhoods and left without a place to live. The construction of TODs doesn't have to be a repeat of urban renewal. Government policies that encourage or require affordable housing in and around TODs can provide new housing units without displacement.

Future

Academics such as Professor Eduardo Penalver of Cornell University have begun to hypothesize that sprawl is ending, and that transit and pedestrian-friendly communities will again emerge as the primary urban form (Penalver, 2007). While current evidence of this change is still in its infancy, a perfect storm of factors is beginning to take shape that could lead to drastic changes in the way we live our lives. Starting with the continuing suburban boom, which began after World War II, history has taught us that a multitude of factors must exist for a major change to occur within the metropolises of America.[12] Steadily rising energy prices and commute times, the threat of global warming, an emerging environmental conscience, a housing market slump, a country on the brink of a recession, income disparities at an all-time high, globalization removing many middle income jobs, an influx of Hispanic immigrants to urban areas, a growing

[12] Hall notes that the rapid construction of new roads, the zoning of land uses that encouraged uniformity in residential tracts, government-guaranteed mortgages, and the baby boom all contributed to the rapid suburbanization (Hall, 316). O'Sullivan adds several complimentary factors such as rising income, higher inner-city crime, poor inner-city education, and the reinforcing effects of jobs and workers both leaving the city (O'Sullivan, 145).

disenchantment with formula retail,[13] and a growing number of surveyed Americans expressing interest in attached and small lot detached housing could possibly be the makings of one such storm. These factors, along with the exponential increase in the last several years of proposals for rail projects around the US, indicate that TODs have the opportunity to be a large part of such a transformation.

Light Rail in Gainesville?

Several major studies have predicted major population increases in the Gainesville Metropolitan Area over the next several decades. The Bureau of Economic and Business Research at UF predicts an average annual growth rate of 1.62% for Alachua County through 2025, leading to an expected population of 301,710 in less than twenty years (Bureau of Economic, 2006). *Florida 2060: A Population Distribution Scenario for the State of Florida* prepared for the 1000 Friends of Florida takes this analysis one step further by continuing these trends for the next fifty years. This analysis predicts that the population of Alachua County will nearly double within the next fifty years to 423,057 by 2060. If this predicted trend were to occur, nearly a quarter million new residents would need to be accommodated within the Gainesville metropolitan area. Even if the results of this study are exaggerated, the possibility of a half million residents within the Gainesville area at some point, whether it be in the next fifty years or later, will require a major change in transportation and land use patterns in order to accommodate this growth while maintaining the current high quality of life in the community.

Pushkarev and Zupan, (1977) generally consider three main factors that affect transit usage: automobile ownership, the density of the non-retail destination, and the quality of transit

[13] Formula retail consists of chain restaurants and big box retailers that, according to the City of San Francisco, rely on a standard trademark, merchandise, uniforms, facade, signage, decor and color at more than 11 stores nationwide. The alternative is locally owned retail that exists independently from a larger corporate strategy.

service. Automobile ownership is most greatly affected by residential density, with a nearby rapid transit station seeing as much as a "tenfold increase in residential density" (Pushkarev and Zupan, 1977). Given the self-reinforcing effects of an effective light rail line, one could likely assume that minimum density associated with a significant increase in the number of non-auto based home trips of 7 units/acre would be easily achieved upon the completion of a passenger rail line (Tri-State Regional, 1970).[14] The important role with which the density of the non-residential destination plays is likely due to the availability of parking. Measured in terms of floor area, Pushkarev and Zupan (1977) contend that a downtown should contain a minimum of 20 million square feet of retail in order to support a single light rail line. The final service measure, quality of service, is generally measured by running time, service frequency, speed, and fares. Vehicle headways (service frequencies) are generally considered to be the most important of these factors, with fifteen minutes or less being the optimal criteria for attracting choice riders.[15]

Given these criteria, the question remains whether a light rail system would be feasible within the City of Gainesville in the next fifty years. The University of Florida contains nearly 20 million square feet of floor area currently (Walker, 2007), with more likely to be built in the next fifty years. Counting the surrounding retail and residential development, this threshold is likely exceeded. Even without light rail, dozens of newly completed or under construction

[14] Pushkarev and Zupan, (1977) recommend an average gross residential density of between 9 and 12 dwelling units/acre for light rail.

[15] Attracting riders through the lowering of fares or providing more frequent service will eventually lose the system money as these factors are inelastic (Pushkarev and Zupan, 1977). Increasing operating speed is elastic and will lead to both greater ridership and a lower cost per rider, but this often requires a large capital investment (Pushkarev and Zupan, 1977). Typically, the only profitable means of gaining ridership from a transit perspective is to either restrain automobile use or increase the residential density of urban development. This higher density performs both functions as it both restrains auto use and encourages the use of public transit (Pushkarev and Zupan, 1977).

residential developments along the corridors of University Avenue and Archer Road easily exceed 12 dwelling units per acre and likely approach the 20 to 30 dwelling units per acre range. Assuming that the quality of transit service would be either matched or exceeded with light rail over the existing bus system, it appears that a climate exists for the provision of light rail within the city in the next fifty years.

Summary

When defining housing affordability as 30% of total income, housing is unaffordable for nearly 40% of all renters within the US. Since transportation costs are directly dependent upon the location of housing, affordability should be based upon the combination of the two costs. Using this measure, most US families spend approximately 50% of their annual income on housing and transportation. While many solutions have attempted to tackle this problem from the housing side, with varying success, few solutions have been offered that take a dual housing and transportation approach.

As passenger rail has seen a re-emergence within the last several decades, mainly as a means to curb sprawl, government officials have realized that their success in this fashion depends on their ability to change land use patterns. With the knowledge that the free market is not likely to fulfill this requirement on its own, a government-regulated approach encouraging transit-oriented development (TOD) has seen increasing use as an accompanying policy to any new fixed guideway infrastructure investment. When constructed properly, TODs have the ability to reduce automobile ownership due to increased access to central business district commuting and create a more centralized local and regional development pattern. While reduced automobile ownership reduces costs for TOD residents, rent premiums around transit increase rents for these same residents. To determine the ultimate effectiveness of TOD as a dual strategy

to promote affordability for low and middle income renters within TODs, the total combined housing and transportation costs must be lower within TODs than outside them.

Based upon current research, light rail does appear to be feasible for Gainesville within the next fifty years. The unique environment, including a large university with restricted parking and a local government which believes in planning, appears to be conducive for light rail, even given Gainesville's relatively small population.

CHAPTER 3
METHODOLOGY

Case Studies

Over the last several decades, planners within academia have established the importance of examining transportation and housing in conjunction with one another. Recently, governmental planning agencies have come to the same conclusion, and at many levels the two are looked at in as one. Given this consensus, it is odd that until recently, affordable housing had been discussed with little regard to transportation. A new emphasis on the creation of mixed use, high density, transit-oriented developments (TODs) around transit stations was not initially intended to be a mechanism for the creation of affordable housing, but these developments may in fact do just that. The case study section of this thesis will attempt to quantify on a purely monetary basis, whether TODs can be justified as a mechanism to produce affordability for residents on the basis of combined housing and transportation costs.

Mockingbird Station along the DART light rail line in Dallas, Texas and Pleasant Hill Station along the BART heavy rail line in Pleasant Hill, California were chosen as the two case studies to test for affordability. Several reasons exist for the decision to select these two stations. The first is the availability of station specific data. Few studies exist that quantify the assessed rent premiums around specific transit stations, an essential factor within the housing and transportation cost model. In order to eliminate the chance for location specific factors affecting the conclusion, an effort was made to include case studies that were distinctly different. The differences between Mockingbird Station and Pleasant Hill Station include: the classification of the rail lines (light vs. heavy), the political ideologies of the areas (liberal vs. conservative), the land use policies and governmental structure within the respective states and regions, and the intensities of land use (urban vs. suburban).

To determine the effectiveness of the TODs at providing affordable housing through reducing the combined transportation and housing costs, a transportation and housing monetary cost model was created for commuters, assuming travel between the area around the TOD and the central business district.[16] While intra-suburban commuting represents a significant portion of all commute trips (40.9%), trips either between the suburbs and the central city or within the central city (those which could possibly be served by a local rail system) represent a larger portion (48.6%) of commute trips (Pisarski, 2006). Regional rail systems may also encourage redevelopment and reinvestment within the central business district, as experienced with the BART in San Francisco, further increasing central city commuting in these locations (Bernick and Cervero, 1997).

To quantify the savings, four different commuters were taken into account: Commuter A lives outside of the station area and drives to work; Commuter B lives outside the station area, drives and parks at the station, and rides the rail line to work; Commuter C lives inside the station area, takes the rail line to work, but still owns a car; and Commuter D lives inside the station area, walks to the station, and takes the rail line to work, but doesn't own a car. Commuter C is assumed to walk, bike, or combine with his commute one-quarter of his non-work trips. The model also assumes that non car owners living within the TOD area (Commuter D) will replace these non-work trips with either walking, bicycling, combining them with their work trips (or at Mockingbird Station by taking transit since they offer monthly passes allowing unlimited rides).[17] In this model, Commuter A, who lives outside the station area and drives,

[16] The cost of leisure time lost during commute was not used in this study, because the ability to afford housing and transportation was deemed of significantly greater importance for low-income and middle-income families than leisure time.

[17] The assumption for Pleasant Hill Station that residents use other forms of transportation besides the BART may not be so unrealistic. In a survey of transit-oriented neighborhoods, few respondents take transit to non-commute

could be equated to the average commuter under a no transit scenario, though this estimate may in fact be conservative due to decreased congestion and decreased rents, [18] which have been shown, in some instances, to occur upon the installation of rail lines. (Boyce, 1972). A diagram of this model is shown in Figure 3-1.

To develop these models, several assumptions were made based on regional and national averages using 2004 as the study year.[19] According to the Bureau of Labor Statistics Commuter Expenditure Guide, the cost of owning a car in the United States (purchase costs, finance charges, insurance, maintenance, licenses, tickets, and fees) in 2004 was $5,762 (U.S. Department of Labor, 2006). This cost has increased substantially from ten years ago when the estimated fixed costs of the automobile were $4,712 a year in 2004 dollars (American Automobile Association, 1993; Bureau of Labor Statistics, 2007). The amount of $5,762 was used in the model for both the Mockingbird Station and the Pleasant Hill station areas because fixed automobile ownership costs are fairly consistent throughout the country.

Fuel efficiency of vehicles, as measured by the Environmental Protection Agency, has remained constant at around 21 miles per gallon for the last 10 years (U.S. Department of Energy, 2006; Gore, 2006). Data for fuel economies of vehicles in California and Texas were not available, thus the national average of 20.8 miles per gallon in 2006 will be used for the model (U.S. Department of Energy, 2006). The model uses a 5:1 ratio of non-work to work trips based on the findings of the 1995 Nationwide Personal Transportation Survey and the 2006 Comminuting in America Report (Niles and Nelson, 1999; Pisarski, 2006). Assuming that most

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destinations on a regular basis. In most cases, less than ten percent of the respondents used transit to non-commute destinations on a weekly basis (Victoria Transport, 2007).

[18] For residents outside of the TOD

[19] When determining the base year for the study, 2004 was chosen because it was the most recent year for which all data was available at the time that the preliminary research began.

Americans take one trip, each way, to and from work every work day (5 days a week), eight non-work trips are generated for each work day. Using the NPTS data, the average non-work trip length can be calculated as 6.7 miles in length (Hanson and Giuliano, 2004). Using 230 work days per year, Americans who use their automobiles as their only form of transportation will drive an average of 12,328 miles per year for non-work related trips.

The final overall assumption to make is the size of the dwelling unit, and a two-bedroom, 1,000 square foot residence was used as the base model. The price of gasoline, the commute distance, the parking expenses, and the annual rent differed for the two case studies and were calculated individually. These costs were combined to calculate the total combined housing and transportation costs for each commuter. The U.S. Department of Labor's Bureau of Labor Statistics Consumer Price Index Calculator was used to convert all monetary amounts from various studies and years to the 2004 base year used in the model (Bureau of Labor Statistics, 2007).

The final goal of the model is to calculate overall affordability. Affordability is typically measured on a per household basis, but the combination of transportation costs and the commuter system employed in this model makes it necessary to differentiate between households with one and two earners, i.e. commuters. The variation in transportation costs between earners, homemakers, and children makes it difficult to formulate a straight forward proportion of combined housing and transportation costs to median income, and therefore an index for housing affordability. Since the combined costs themselves demonstrate the degree to which affordability varies by commute choice and housing location, the main purpose of the affordability measures should be to compare the two case studies. For comparison, the simplest configuration of a one-person, single-earner household is used in order to reduce additional

assumptions for the number of family members, earners, and commuters in each household and their trip patterns.[20]

The widely considered measure of combined housing and transportation affordability is 50% of total income. Thus, for this analysis, affordability is determined based on whether the average median income for single earners living alone within the census tracts surrounding each station is more than double the combined housing and transportation costs, for each commuter A through D. Since the report focuses on low and middle income residents, affordability is only calculated for renters, given that the financially disadvantaged are disproportionately renters rather than homeowners (Alachua County, 2003).

Gainesville Application

Background

At an October 11th, 2007 meeting of the Gainesville Metropolitan Transportation Planning Organization, Director Marlie Sanderson, in a discussion of long range transportation scenarios named the third of four as a light rail alternative. Sanderson (2007) named four questions that would be answered through the study of alternative three:

> Number one, will the City of Gainesville have enough people and enough jobs to support a light rail system in the year 2060? Number two, will these people and jobs be located in close proximity to the light rail system... Number three, will the light rail alternative reduce overall traffic congestion as compared to the other alternatives…. Finally, what is the impact on Alachua County's air quality?

Commenting specifically on the third alternative, Gainesville City Commissioner and member of the Metropolitan Transportation Planning Organization, Ed Braddy (2007) stated that

[20] The station-wide savings for multiple member and multiple earner households will likely be fairly similar, however, the total savings, and proportion affected may be entirely different. Two-member households with two vehicles will be much more likely to relinquish a single automobile than a one-member household would be to do without their one and only vehicle, so a larger proportion of two-member households may save money within TODs than one member households. The savings, though, will be much greater for those one-member households which live within the TODs and do not need to own an automobiles.

since we like to connect transportation and land use, that we must also determine whether "at the end of the day does [this alternative] increase social welfare or decrease it?" Insinuating that the light rail alternative would pose a cost burden on lower and middle income families, Braddy (2007) went on to say that "we should look around and follow the models to see what this means to our citizens in terms of cost."

Why Alternative Three?

Alternative three was selected for examination because rail is the only current mode of transportation that effectively functions as the transit in transit-oriented development, because it is the only mode of transportation that causes a market response. Given the time-frame of a 50 year long range transportation plan, the possibility exists that a new form of transportation will emerge that will change the way we approach transportation planning; however, as the manufactures of the Segway learned, it may be more difficult than expected. Currently no alternative form of transportation has been developed that will deliver an entirely different method for moving between two points in the next fifty years than exists today. Some companies such as Taxi2000 and Unimodal claim that personal rapid transit, an adaptation of the "people mover" which functions much like a horizontal elevator, will be the urban transportation mode of the next fifty years, but the massive infrastructure costs and the aesthetic issues with such a transportation mode will likely limit it to only selective uses. Given these uncertainties, the Gainesville 2060 transportation scenario will model its light rail system and vehicles after the currently successful systems found in Portland, Oregon and Dallas, TX.

Expected Results and Limitations

Given the fifty year time horizon of a long range transportation plan, an accurate economic model is difficult to construct. The transportation cost calculations will be based on the models of the two case studies and on previous research and will place cost in 2004 dollars. The

location of the light rail lines will be based on the preliminary draft of alternative three presented at the October 11th MPTO meeting. Projected population increases will be based on both BEBR projections and the 1000 Friends of Florida 2060 study, and the location and intensities of the increases in population will be based on those densities needed to sustain a light rail line. The end result of this section of the report will be to determine the monetary effect on overall housing and transportation affordability in the areas within proximity of the light rail lines in Gainesville, Florida and the proportion of the population that would be affected.

Gainesville Methodology

Most people will walk a distance of a quarter mile or five minutes from their residence to a destination before opting to drive or ride a bike rather than walk (Duany, Plater-Zyberk, and Speck, 2000). When speaking in terms of urban mass transit, both one-quarter mile and one-half mile distances have been used as values that have been most strongly associated with accessibility, ridership, and rent premiums around TODs, though one-quarter mile is most typically used (Cervero et. al., 2004). Using the quarter mile walking service area for transit stations, Holtzclaw (1994) claims a net residential density of 30 units/acre is required to support light rail transit, [21] while Pushkarev and Zupan (1977) believe that a density between 9 and 12 units per acre is necessary. For Alternative Three, three densities will be used: Holtzclaw's 30 units/acre for Urban TODs, Pushkarev and Zupan's 10 units/acre for Suburban TODs, and a middle value of 20 units/acre for Transition TODs.

Two major alignment choices for light rail were presented at the October 11th meeting of the MTPO which proposed the light rail alternative. The two possible alignments were (1) from

[21] This density may be somewhat unrealistic, as the same study lists a required residential density of 24.8 units/acre to support two buses per hour. Given that Gainesville's densest census tracts have a net residential density of around 3.5 units/acre, and no sizeable areas with densities approaching this value, and since RTS still operates buses at a rate of two buses per hour or higher on over a dozen routes, such a high density may not be needed in this case.

Interstate 75 east along Archer Road and then traveling along a former rail corridor through the south part of Gainesville and then turning northeast along Waldo Road before terminating at the Gainesville Regional Airport and (2) beginning at Newberry Road near Interstate 75 and continuing east along Newberry Road until it becomes University Ave, travels through the downtown then turns southeast on Hawthorn Road, and finally terminating at the Gainesville Regional Airport. For this study, an alignment along Newberry Road, University Avenue, and Waldo Road was chosen. Several reasons exist for this choice. First, a large amount of student housing currently exists on the northern part of the University of Florida, and this housing should be reinforced. Second, an Archer Road alignment would travel along the south side of campus, while a University Avenue alignment would travel along the north side of campus. The advantage to traveling along the north side would include the access to the O'Connell Center and Ben Hill Griffin Stadium during sporting events and the commercial corridor which exists near campus on University Avenue and the larger concentration of classrooms found near the northeast end of campus. Third, the alignment along University Avenue would travel though the downtown area and reinforce the commercial office, retail, and residential development already existing there.

The Newberry Road - University Avenue - Waldo Road alignment also connects several important Gainesville institutions which will likely occupy the same location in fifty years, including: the Gainesville Regional Airport, the North Florida Regional Medical Center, the University of Florida, and the historic downtown. Under this proposed light rail scenario, Archer Road will function as a "B" street that collects the land uses that would be incompatible with new urbanist-style transit-oriented developments, such as car dealerships, gas stations, and big box stores.

In order to determine the area around each station that would be available to be redeveloped under a light rail scenario, several criteria must be considered. Given that redevelopment is recognized to likely occur within one-quarter mile, but at no greater than one-half mile, all parcels within one-quarter mile of the light rail station are to be initially included as possible areas of redevelopment, but portions of these parcels at distances greater than a half mile are to be excluded. The assumption here is that parcels with portions of their land outside of the quarter mile distance will use this land for non-habitable uses such as parking and drainage structures, and that the majority of the residential dwellings will be constructed either within the quarter mile distance of the station or near it. Upon selecting these initial parcels for each TOD, uses that would be presumed to remain the same in 50 years, and therefore not be subject to redevelopment, will be excluded. These uses include: cemeteries, hospitals, parks, recreation trails, The University of Florida, the Gainesville Regional Airport, natural water features (lakes, ponds, rivers, and wetlands), and right of way.

Based on the research of Pushkarev and Zupan (1977), a minimum of 20 million square feet of building area are needed within the downtown to support a line-haul light rail system. The University of Florida currently contains nearly 20 million square feet of building space, and when combined with the nearby retail along University Avenue, the combined building area likely surpasses this threshold currently. Based on existing trends, this building area will continue to grow over the next fifty years, and when combined with Gainesville's downtown, two principal commute destinations will exist. The commitment from RTS to provide high quality service combined with the ease with which the City grants permits for and encourages high density development when appropriate makes it likely that the MTPO would have a case for a ten mile first phase of a single light rail line by 2060.

Gainesville TOD Locations

Given the alignment of the line, the locations of the stations and the TODs must be determined. While no station spacing has been definitively associated with higher ridership (Kuby, Barranda, and Upchurch, 2004), suburban to urban systems built within the last several decades such as the Portland's MAX and the Dallas's DART have station spacings of slightly under one mile. Using this spacing, the following criteria are to be used to locate stations and TODs along the line: near permanent destinations (i.e. the university or the airport), near major intersections, near major retail centers, near major office centers. More specifically for locating TODs, positive site characteristics include blighted areas in need of redevelopment, current activity centers, and larger parcels with fewer owners, while negatives characteristics include areas that are undesirable to be redeveloped such as historic neighborhoods, the University of Florida, and restricted development areas surrounding the airport.

The major difference between stations classified as TODs and those that are not involves the amount of government intervention. The classification of stations as TODs indicates increased planning and regulation around stations in order to encourage the types of land uses which the rail system will require to be effective. Spreading these funds and resources around stops which are already developed to a suitable level or are at the far outskirts of town will decrease the amount of resources available at the more critical stations. Stations with decreased intervention will also provide an opportunity for the private sector to demonstrate their ability to provide the types of housing and uses compatible with a light rail line, providing a means of comparison. The Gainesville light rail line, including stops and TODs, is shown in Figure 3-2.

TOD Classifications

No two TODs are created equal, nor should they be. Different geographic, demographic, and environmental factors effect and shape the design of each TOD in each individual location.

Though differences do exist, some uses should be excluded from all Gainesville TODs: automobile sales and service, heavy industry, storage, equipment sales and repair, drive-through service, and scrap, salvage, or recycling centers (City of Austin, 2006). All TODs should also be designed with the transit station as the focal point of both the TOD and the entire neighborhood. Automobiles, pedestrians, and bicyclists should all be accommodated on a well connected street pattern. Large setbacks should be avoided for all structures, and commercial and multi-family residential buildings should be built adjacent to the street. For the purposes of this study, the proposed TODs within Gainesville were divided into three general categories: suburban, transitional, and urban.

Suburban

Suburban TODs are to be located towards the ends of the light rail line far removed from the central business district. Suburban TODs should consist principally of residential development, while allowing for some neighborhood retail and restaurants clustered around the center of the development near the station. The residential density should average 10 units/acre and contain small-lot single family detached and attached housing, granny flats, and duplexes. Parking should be provided both for the commercial businesses and for use as a park-and-ride; however, parking should not be concentrated around the station, but rather hidden in enclosed garages or placed behind the buildings, away from the street.

Transitional

Transitional TODs are to be located in areas around the edge of the suburban/urban boundary. Transitional TODs should consist of a mixture of housing, retail, restaurants, nightlife, and office development. A gross residential density of 20 units/acre should be maintained through a mixture of duplexes, townhouses, row houses, apartments, and mixed-use multi-family buildings with ground floor commercial. Transitional TODs should not be

designed to function as a park-and-ride, as parking should only be allowed for local residents and businesses.

Urban

Urban TODs are to be located in and around the central business district or central commute location (in this case the University of Florida). Unlike the other TODs, office development is given priority over residential development within urban TODs. Other commercial uses such as retail, restaurants, and nightlife should also be located along the ground floor of these buildings, as a secondary function, to form an overall employment density of at least 50 employees/acre (Ewing, 1999). While not the focal point of urban TODs, residential development should also be provided, and at a high density. Gross residential densities should average 30 units/acre through a mix of row houses, multi-family apartments, and condos. No parking should be provided for transit, with limited parking (either on-street or in hidden garages) for residents and commercial service businesses. The principal means of transportation within the downtown should be through walking, bicycling, and transit.

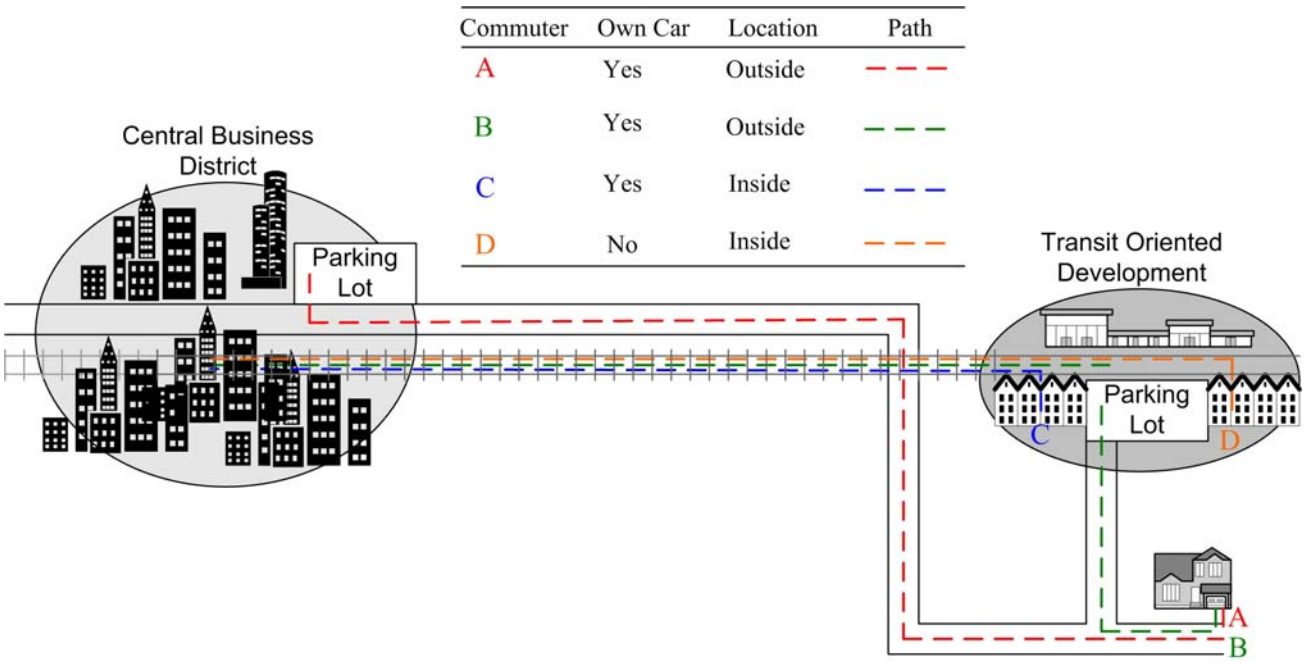

Figure 3-1: Four Types of Commuters Used in the Case Studies

Figure 3-2: Proposed Gainesville Light Rail Line

CHAPTER 4
CASE STUDIES

Introduction

While Pleasant Hill Station and Mockingbird Station differ greatly, from their regional location to their design, both are widely regarded as successful TODs. Initially, this section will provide both qualitative and quantitative background information in order to help illustrate what has made each TOD successful. The primary intention of this section though, will be to test the combined housing and transportation costs for single-member, single earner households within the two station areas. A comparison of the costs will be made for a series of commuters that will take into account both location, modal choice, and automobile ownership. The final result of this section will be the development of a series of conclusions based on the results of the two case studies which can be applied to cities throughout the United States, including Gainesville.

Pleasant Hill Station

Background and Overview

Pleasant Hill Station is located on the edge of the Northern California, East Bay suburbs of Pleasant Hill and Walnut Creek. The two suburbs combine for a population of around 100,000, with nearest major employment center, Oakland, located about 15 miles southwest. Pleasant Hill Station, which first opened in 1972 along Interstate 680, is part of the yellow line of the Bay Area Rapid Transit (BART) system that runs from Pittsburg/Bay Point through Oakland and San Francisco and ends at Daly City. The BART system consists of hundreds of electric powered trains that can reach speeds in excess of 80 mph, and the system is classified as heavy rail since it operates with ten or more cars on a dedicated right-of-way (Bay Area, 2006). Trains typically stop at Pleasant Hill Station every fifteen minutes, though this decreases to five minutes during A.M. and P.M. peak periods, and a roundtrip ticket from Pleasant Hill Station to the financial

district of San Francisco costs $8.80 (Bay Area, 2006). As of 2002, the ridership at the station was over 6,300, with 74% these riders using the station as a park-and-ride, and only 15% walking (State of California, 2004). The station is surrounded on all directions by 3,500 surface and garage parking spots that are typically filled to capacity on weekdays (State of California, 2004).

Cervero and Landis (1997) consider Pleasant Hill station the best example of suburban transit oriented development in the U.S. Within a five year time period during the late 1980s and early 1990s, 1.5 million square feet of office space and 1,800 housing units were constructed within a quarter mile of the station (Cervero and Landis, 1997). This development occurred despite being located in an unincorporated area with the largest parking lot along the BART line. Cervero (1993) credits Pleasant Hill's success in attracting housing and office development to three main factors:

> One, the creation of a specific plan in the early 1980s that served as a blueprint for guiding growth near the rail station over the ensuing 15 years; second, the existence of a proactive redevelopment authority whose staff aggressively sought to implement the plan by assembling irregular parcels into developable tracts, seeking out private co-ventures, and investing in public infrastructure; and third, having a local elected official who became the project's "political champion", working tirelessly and participating in numerous public hearings to shepherd the project through to implementation.

A survey of station-area land uses and residents was conducted in 2002 that covered a half mile radius around the station. The predominant zoning type surrounding the station was residential; medium and high density residential accounted for 44%, and low-density residential accounted for 36% of the zoning around the station by area (State of California, 2004).[22] Of the

[22] Definitions from State of California (2004): "Residential-Low Density corresponds to the local jurisdiction definition of low-density residential for each TOD. Generally, low-density residential refers to single-family houses. Residential-Medium/ High Density corresponds to the local jurisdiction's definition of medium/high density residential for each TOD. Generally, medium-density residential refers to apartments, townhomes, condominiums, and small-lot single family homes two stories or higher. High-density is generally three stories, depending on the local jurisdiction's zoning designation."

5,129 station area residents, 65% were renters, and 30% took public transit to get to work (State of California, 2004). Between 1990 and 2000, an influx of families making over $75,000 a year moved into new duplexes and apartments in the area and the station area population increased by 27% (State of California, 2004). While the station area median income increased from $37,271 to $52,868 over this time period, 11% of the population still earned less than $15,000 per year, which corresponded to the percentage of station area residents not owning a vehicle (State of California, 2004). A 1994 study of housing prices in the Pleasant Hill station area and the surrounding region for units of similar size, age, and amenities found that one-bedroom units near the BART station were $1.20 per square foot, per month, compared with $1.09 per square foot, per month, outside the station area (Cervero et. al., 2004). Rents for two bedroom units also increased from $0.94 per square foot, per month, outside the station area to $1.20 per square foot, per month, inside the station area (Cervero et. al., 2004). A recent proposal has been accepted that would re-develop the BART station from a suburban mall style design to a walkable urban village. Plans call for 300,000 square feet of office space, 42,000 square feet of restaurant and retail, at least 300 townhouses, and a child care facility, but as of yet, no requirement has been made for the provision of affordable housing, even though the project will be partially publicly funded (State of California, 2004).

Model

When calculating the gasoline costs in the model, the costs for Commuters A-D will differ, since their work commuting patterns directly affect their annual expenditure on fuel. Gas prices are not directly linked with inflation, nor have they been proven to significantly affect the prices of parking, public transit, vehicles, or housing rents in the short term; therefore, to be consistent with the rest of the model, the United States Energy Information Administration's average 2004 gas price for the San Francisco Bay Area of $2.16 per gallon was used (Metropolitan

Transportation Commission, 2007). According to Google Maps, the driving distance between the Pleasant Hill Station area and the central business district of San Francisco is 27 miles, or 54 miles roundtrip (Google Maps, 2006). The trip also includes a one-way toll of $4 for crossing the Bay Bridge. Assuming that the commuters work 230 days a year, the total gasoline and toll costs for an automobile commute are $2,020. Based on the station spacing and the 1998 Pleasant Hill Station trip origin survey, a 2 mile trip distance was used for commuters making the driving portion of their work trip to the park-and-ride. This trip length, twice for 230 days, equals 920 miles of work miles driven for park and ride commuters for an annual cost of $95. Using 12,328 as the average number of miles for non-work trips,[23] the average automobile commuter living outside the TOD spends $1,298 a year on non-work trips, while commuters inside the TOD area spend three-quarters of that amount ($974).[24]

The costs of riding the BART to work and parking downtown were determined explicitly through prices listed currently on their respective agency websites. The price of a roundtrip ticket from Pleasant Hill Station to Montgomery Street Station in the central business district was listed at $8.80 on the BART website in 2006. When buying in bulk, BART offers a 6.25% discount on the final ticket cost, bringing the total annual investment for 230 days of commute to $1,900 (Bay Area, 2006). Since BART fare increases are tied to inflation, the 2004 costs can be calculated as $1,780. While the cost of parking at Pleasant Hill Station is free, the annual cost of parking in downtown San Francisco is nearly equal to the amount spent each year for the ownership of an automobile. The current average monthly cost of the eight parking garages in the downtown/financial district is $346, for a yearly cost of $4,155 (City of San Francisco,

[23] 12,328 miles per year for non-work trips was established in the methodology.

[24] Based on the previously stated assumption that TOD residents will either combine/reduce trips, or use other forms of transportation than the automobile for one-quarter of all non-work trips.

2007). When adjusted for inflation to the base 2004 year, the total falls to $3,734 (Bureau of Labor Statistics, 2007).

The final component of the model to determine concerns housing costs. The base residence used for the model is a two-bedroom, 1,000 square-foot dwelling unit. The Bureau of Labor Statistics (2007) reported an increase in the value of the dollar between 1994 and 2004 of 27%; hence, the rate of $1.09 per square foot, per month inside the Pleasant Hill Station area was adjusted to $1.38 per square foot, and the rate of $0.94 per square foot, per month outside the transit station area was adjusted to $1.19 per square foot. These inflationary adjustments led to annual housing costs of $16,560 for residents inside the station area and $14,280 for residents outside the station area.

Using these individual totals, the cumulative housing and transportation costs were determined for each Commuter, A-D. The highest total commute cost was experienced by Commuter A, who lived outside the station area and chose to drive to work. Commuter A, which represented 58% of the station area population in 2000, spent a combined $26,704 on transportation and housing (State of California, 2004). Commuter C represents the majority of Pleasant Hill Station users, and though they don't use a car at all during work trips, they paid the second highest total transportation and housing costs at $25,076. Commuter B paid over $3,400 less annually than Commuter A by simply choosing to park and ride the BART downtown rather than drive the entire distance to work. Commuter B represents the majority of the users of Pleasant Hill Station and paid $23,215 a year in combined housing and transportation costs. While Commuter D (those not owning a car) represents only 11% of station area residents, they paid the lowest combined housing and transportation costs at $18,340 a year. A detailed chart of the calculations for each commuter is found in Table 4-1.

The model used produced some important insights into the savings provided by transit-oriented developments in suburban locations far removed from a dominant central business district. Irrespective of location and car ownership status, the most financially responsible decision appears to be using Pleasant Hill Station and the BART yellow line for a commute to downtown San Francisco. While the BART fares are fairly high, inflated parking prices downtown more than overshadow the cost of transit ridership. The cost of driving to the station to use it as a park and ride is not offset by rent premiums experienced around the transit stop, and therefore living in the station area in order to walk to Pleasant Hill Station and ride the BART to work is only cost-effective if enough amenities are located along the transit line and within walking distance of one's residence that owning an automobile is optional.

The next analysis to perform on the model is the degree of affordability of the four commuters. Given the previous assumption that the commuters are single earners living alone, the average median income for this classification of residents within the census tracts surrounding Pleasant Hill Station in 1999 was $41,577 (U.S. Census, 2001b), which translates to $47,142 in 2004 (Bureau of Labor Statistics, 2007). Combined housing and transportation costs constitute the following percentages of median income within the station area for the four commuters: Commuter A – 56.6%, Commuter B – 49.2%, Commuter C – 53.2%, and Commuter D – 38.9%. Based on the commonly held threshold of 50%, commuters B and D are considered to be affordable living options. Living within the station area makes trading in your car a necessity for affordability, while living outside the station area and using the BART as a park and ride is another affordable option. Commuter A, which most accurately represents the default scenario had public transportation not been available, remains the least affordable.

Mockingbird Station

Background and Overview

Mockingbird Station is located along the U.S. 75 Expressway in Dallas, Texas, approximately 3.5 miles north of the northern perimeter of the central business district. The station is in an urban location across the interstate from Southern Methodist University, a private university with an enrollment of 11,000. The area immediately around the station was designed and constructed entirely through private investment with the intent to create an urban village. This station development contains 211 loft-style apartments, 150,000 square feet of office space, ten clothing stores, nine restaurants, an eight screen independent movie theatre, and a grocery store (Ditmar & Ohland, 2004). The station also has the capability of serving as a park-and-ride facility as it contains 1,440 parking spots, mainly located in garages and underground, though it is equally accessible for pedestrians (Ditmar & Ohland, 2004). Ken Hughes, the chief developer of the project, claimed the freeway adjacency was what sold investors on the project, while the transit adjacency was an afterthought (Ditmar & Ohland, 2004). New phases under consideration include an eighteen story hotel with ground floor retail, cooperation with local and federal governments to provide better accessibility to pedestrians on the opposite side of the expressway, a connection with a hiking and biking trail, and providing insulation from the noise of the highway.

Mockingbird Station is currently served by both the red and blue lines of the Dallas Area Rapid Transit System (DART), a light rail system that opened in 1996. An annual pass for the DART was very reasonable for commuters at only $400 in 2004, and an average trip from Mockingbird Station to City Hall takes approximately 8 minutes, with trains arriving every 15 minutes (City of Dallas, 2006a). On-site residential rents were 30% over market rate as the loft apartments rented for $1,500 per month, while the penthouses rented for $5,000 per month

(Ditmar & Ohland, 2004). In 2003, residential rents inside the station area were $1.60 per square foot, per month compared with $1.30 per square foot, per month for similar areas not served by DART (Cervero et. al., 2004: 164). Over a one year time period, the rents calculate to $19,200 for dwellings inside the station area, and $15,600 outside the station area. Adjusting for inflation to the 2004 study year, the annual rents rise to $19,711 and $16,015 respectively.

Model

The price of gas, along with the commute distance traveled, were significantly different in Dallas than in the San Francisco Bay Area. The United States Energy Information Administration's average 2004 gas price for the State of Texas was $1.84 per gallon (Energy Information Administration, 2005). According to Google Maps (2006), the driving distance between the Mockingbird Station area and the central business district of Dallas is 6 miles, or 12 miles roundtrip. Using the 230 days a year work schedule, the annual gasoline cost were $242 for an automobile work commute, $1,298 and $974 for non-work trips for non-station area and station area residents respectively, and $142 for drivers outside the station area traveling to Mockingbird Station to use it as a park-and-ride. While the cost of parking at Mockingbird Station is free, the cost of parking in downtown Dallas in 2006 ranged from $600 to $3,000 annually (City of Dallas, 2006b). The average yearly expense of all downtown parking was $1,200, and when adjusted for inflation, $1,124 was used for this model (Bureau of Labor Statistics, 2007). Based on the station spacing and urban layout, a 3-mile trip distance was used for commuters making the driving portion of their work trip to the park-and-ride. This trip length twice for 230 days equals 1,380 miles of work miles driven for park and ride commuters for an annual cost of $142.

Using these costs, the total housing and transportation costs for residents in and around Mockingbird Station was determined for Commuters A-D. The total annual expenses in order

from highest to lowest were Commuter C - $26,847, Commuter A - $24,441, Commuter B - $23,617, and Commuter D - $20,011. A detailed chart of the calculations for each commuter is found in Table 4-2 at the end of the chapter.

The Mockingbird Station model, with a mid-density urban transit station located within close proximity of downtown, produced significantly different results than the study of Pleasant Hill Station. Not owning a car and living near a transit station was still the least expensive way to live, but living near a transit station, taking the DART to work, and still owning a car was by far the most expensive. For those living outside the station area, the difference in commute costs between taking the DART to work and driving to work were fairly insignificant. These differences are due to the 20% rent premiums around the transit stop, the decreased parking rates, and shorter commute distances relative to San Francisco and Pleasant Hill Station.

Similarly to the study of Pleasant Hill Station, the average median income for single earners living alone in the census tracts surrounding the station was used as the base measure used for determining affordability. According to the U.S. Census Bureau, the median income for these residents in 1999 was $37,697 (U.S. Census, 2001b; U.S. Census, 2001c), or $42,743 in 2004 dollars (Bureau of Labor Statistics, 2007). Combined housing and transportation costs then comprise the following percentages of median income within the station area for the four commuters: Commuter A – 57.7%, Commuter B – 55.3%, Commuter C – 62.8%, and Commuter D – 47.1%. Based on the 50% threshold of affordability, Commuter D is the only affordable option of all commuters, requiring living within the station area, not owning a car, and either taking transit, walking, or biking for all trips. The most expensive option for commuters is living within the station area while also owning a car. Unlike Pleasant Hill, car owners living within

the station area receive a reduction in affordability over the no transit, base model of Commuter A, though neither option appear affordable.

Case Study Conclusions

The Mockingbird Station and Pleasant Hill Station transit-oriented developments provide two different perspectives on TODs from design, to implementation, to location. Using the major benefits of TODs outlined in previous sections of this report as the goals, the results from these two locations were similar in many respects. It is unclear from either development whether the projects were a catalyst for economic growth. In the last fifteen years, apartments and condos have replaced lower density development around Pleasant Hill Station, while Mockingbird Station provided for a myriad of restaurants, retail stores, and loft apartments on-site. Neither project made an attempt to provide for housing diversity or affordability, and both projects noticed significant rent premiums for properties near the transit stations.

Though development occurred in and around these developments, it cannot be determined from the studies conducted whether these economic impacts were redistributive or generative, though in the case of Pleasant Hill Station, Cervero and Landis's (1997) previous research indicates a redistribution – meaning the successful reduction of sprawl. The main purposes of both Pleasant Hill Station and Mockingbird Station were to serve areas that were the product of sprawl, but the clustering affects around the stations may serve to reduce sprawl as high density development around these stations replaced low-density development farther away from the station.

The one goal of transit oriented developments which likely had different outcomes at each station was the encouragement of physical fitness. Pleasant Hill Station, which is surrounded by garage and surface parking on all sides, similar to a suburban mall, does not encourage use by pedestrians, and thus the vast majority of station users drive to the station. Mockingbird Station

encouraged pedestrian access by making it equally accessible for pedestrians and drivers alike. Financially however, the least expensive option in the Mockingbird Station housing and transportation cost model, assuming car ownership, was to live outside of the station area and drive to the station and use it as a park and ride.

Based on the results of these two case studies, the ultimate effectiveness of transit-oriented developments at providing a relief to the combined housing and transportation cost burden experienced by low and middle income families appears to be whether TODs can make living without an automobile a realistic option. Though the costs are not to be taken scrupulously, some general trends can be taken from the theoretical model. When work commute requires a long travel to a dense downtown with extreme parking rates, taking transit is the least expensive means of traveling to work, even if you have to drive to get to the transit stop. This situation is an extreme case though, most likely only found in the San Francisco, New York, Chicago, Boston, and Washington D.C. metro areas.

In most major metropolitan areas, the main value for TODs in lowering the total cost of housing and transportation exists when other services such as supermarkets, doctors' offices, restaurants, and retail stores are either provided onsite, or access to these services is made available through the transit system, and one does not need to own a car to function on a day to day basis. Mockingbird Station in Dallas came close to this model, but the services provided on-site most likely out-price the majority of middle and lower income residents, and the principle destinations of the blue and red lines is downtown, rather than to commercial service corridors where low income employees in Dallas typically work. Successful TODs that serve all income levels will likely have to be large, dense, mixed-use, at least partially publicly funded, and connect with an extensive transportation network that links to not only commercial offices, but

commercial service businesses. This all or nothing approach to transit-oriented developments will be a tough sell for communities, as it requires developers to make a very significant initial investment, and local government officials to operate on a long-range horizon.

Based on these two case studies and similar projects around the country, developers are unlikely to develop affordable housing unless public funding is provided and affordable housing is a requirement. While living near a highway or major thoroughfare typically decreases residential rents due to noise and air pollution, electric powered rail systems have proven to have a positive effect on local rents. The most attractive factor of TODs from a developer's perspective is the inflated prices that they can charge tenants due to the accessibility to public transit. This inflated price, or rent premium, is the main factor that prevents low and middle income households from living in TODs, while at the same time being a developer's chief reason for building here rather than in the suburbs (barring a substantial shift in market demand). For developers to charge decreased rents, they expect some form of monetary compensation from the government, making a public-private partnership a must.

The main question of these case studies boiled down to whether the rent increases around transit compensate for the decreased transportation costs. The answer to this question depends on whether the family owns an automobile. If a family living in or near a TOD owns an automobile, then the transportation and housing costs will likely slightly increase, while if the family does not own a vehicle, the total transportation and housing costs will significantly decrease. Assuming that low-income families own cars for survival purposes rather than leisure purposes, this indicates that the main obstacle to the effectiveness of transit-oriented developments at lowering combined housing and transportation costs is not rent premiums, but connectivity to jobs and services. If a long range regional plan is in place that requires that the

land uses and activities necessary to subsist are located at or near rail stations, not just arterials, then transit oriented developments around fixed guideway transit systems appear to be effective at increasing affordability.

Table 4-1: Pleasant Hill Commuter Costs

	Commuter A	Commuter B	Commuter C	Commuter D
Transportation Costs				
Automobile Ownership	$5,762	$5,762	$5,762	$0
Gasoline	$3,288	$1,393	$974	$0
Transit Fare	$0	$1,780	$1,780	$1,780
Parking	$3,374	$0	$0	$0
Housing Costs				
Base Price	$14,280	$14,280	$14,280	$14,280
Rent Premium	$0	$0	$2,280	$2,280
	$26,704	$23,215	$25,076	$18,340

Table 4-2: Mockingbird Station Commuter Costs

	Commuter A	Commuter B	Commuter C	Commuter D
Transportation Costs				
Automobile Ownership	$5,762	$5,762	$5,762	$0
Gasoline	$1,540	$1,440	$974	$0
Transit Fare	$0	$400	$400	$400
Parking	$1,124	$0	$0	$0
Housing Costs				
Base Price	$16,015	$16,015	$16,015	$16,015
Rent Premium	$0	$0	$3,696	$3,696
	$24,441	$23,617	$26,847	$20,111

CHAPTER 5
APPLICATION FOR GAINESVILLE IN THE NEXT 50 YEARS

Lessons Learned from Case Studies

So what do the results of these case studies combined with the current body of research on the topic tell us about plans for light rail in Gainesville in 2060? Barring the invention of new technology that drastically changes the way people move and communicate, the key to providing affordable housing and transportation to more families will likely involve the ability of light rail to reduce the need of Gainesville residents to own a personal vehicle. The current land use pattern will likely not provide this type of environment, but the provision of rail in many cases has had a significant impact on the surrounding land use patterns through a combination of market forces and the focused planning which occurs around stations. Given the unique conditions that exist in a University town such as Gainesville, the opportunity exists for a discussion of light rail within the next 50 years. Given the political nature of such a proposal, the determination must be made regarding how such a project will affect the combined housing and transportation affordability of Gainesville residents, and what segment and proportion of the population will be affected.

The basis for determining the affordability of housing and transportation for the two case studies relied on a series of four commuters. Based on the number of TODs and the number of assumptions needed for such a long-range study, constructing this type of model for Gainesville in 2060 is impractical. Based on the case study results, the two principal factors affecting housing and transportation affordability were car ownership and rent premiums. Reconnecting America's (2004) nationwide study indicated a 44% decrease in automobiles per household in areas within a half-mile of fixed-guideway transit stations (p. 21). Based on Canby's (2003) study, using transit instead of owning a car can save an average of $4,900 per worker per year.

Therefore, households within TODs in Gainesville could expect a $2,156 reduction in cost per household per year (in 2004 dollars) due to the decrease in automobile ownership. Taking the average rent premiums experienced in the two case studies as 20% and the yearly median gross rent in Gainesville as $7,884, an average rent premium of $1,577 (in 2004 dollars) per household would be experienced by residents living in TODs (Alachua County, 2003). Subtracting the rent premium from the reduction in transportation costs would lead to an average savings of $579 per household.

Currently within the City of Gainesville, 52 percent of the population are renters. The product of this percentage, the average costs savings per household, and the total number of households located within each TOD will be used to determine the total housing and transportation cost savings for residents over the entire proposed light rail line in 2060. The proportion of the population affected will determined by dividing the total number of households living within TODs by the total number of projected households within Gainesville in 2060.

Gainesville TOD Descriptions

Oaks Mall/North Florida Regional Medical Center

The westernmost stop on the line currently serves as a suburban-style regional activity center with the Oaks Mall and North Florida Regional Medical Center (NFRMC) as the primary uses (shown in Figure 5-2). Due to the distance from the University of Florida and the downtown, the area should be developed as a suburban TOD with some on-site parking provided for commuters West of I-75. Given the cost of relocation, the NFRMC will likely remain in its current location and serve as a primary destination for residents from the east side of town to receive medical care. Given the competitiveness of the commercial retail sector, malls are typically forced to renew themselves every several decades to remain competitive. This will likely be no exception for Oaks Mall within the next fifty years, as the large tract of land within

proximity of a rail line will likely redevelop into a walkable, mixed-use community to take advantage of the full development potential of the light rail line. Several other strip commercial centers surround the Oaks Mall and will likely also redevelop to a more suitable use. Upon exclusion of the NFRMC, a total of 160 acres remain for redevelopment. Using the residential density of 10 units/acre for suburban TODs, approximately 1,250 new units could be built on this site. Figure 5-9 shows the parcels to be redeveloped around the Oaks Mall and NFRMC station.

Forty-Third Street and Newberry Road

The area around the 43rd Street and Newberry Road intersection is currently home to suburban-style offices surrounded by middle-income single family residential development, shown in Figure 5-3. This station is classified as a transitional TOD due the location within two miles of the University of Florida campus, while still located in a suburban neighborhood. No lands were excluded for development within this TOD except for a section of right-of-way that currently holds the Millennium Center office park. Several large parcels surround the proposed station location that should allow for the development of a master planned, mixed-use transitional TOD. A total of 184.9 acres are available for redevelopment within the station area, allowing for a total of 3,698 units to be constructed at 20 units/acre. Figure 5-10 shows the parcels to be redeveloped around the 43rd Street and Newberry Road station.

Thirty-Fourth Street and University Avenue

The 34th Street and University Avenue area currently exists as suburban activity center within an urban area. The area is home to strip malls, automobile related businesses, and vast parking areas adjacent to the street, shown in Figure 5-4. This station should be developed as a suburban TOD due to its location on the northwestern edge of the University of Florida campus. Two tracts of land were excluded from this analysis, the University of Florida golf course, and a portion of the Hogtown Creek watershed. Many of the strip malls and commercial areas are

consolidated onto single tracts, making redevelopment into mid-rise buildings, mixed-use buildings an easier proposition. A total of 158.6 acres are available for redevelopment within the station area, allowing for a total of 4,758 units to be constructed at 30 units/acre. Figure 5-11 shows the parcels to be redeveloped around the 34th Street and University Avenue station.

Thirteenth Street and University Avenue

The corner of 13th Street and University Avenue should be one of the principal intersections of Gainesville that serves as a lasting image of the city. As it stands now however, the corner containing the University remains the only quadrant holding up its end of the bargain, as a gas station, a bulldozed empty lot, and an outdated hotel occupy the other three portions of land surrounding the intersection. Several hundred feet north of the intersection however, several medium density, mixed-use structures (shown in Figure 5-5) have been constructed that may serve as a model for future redevelopment. Due to the balkanization of parcels in this section of town, redevelopment efforts will be increasingly difficult, though the prime location will likely keep developers interested. The location at one of the principle intersection between the University and downtown, the 13th Street and University Avenue area provides an opportunity for an urban TOD. Upon excluding the University of Florida, a total of 77.65 acres remain available for redevelopment within the station area, allowing for a total of 2,330 units to be constructed at 30 units/acre. Figure 5-12 shows the parcels to be redeveloped around the 13th Street and Newberry Road station.

Waldo Road and University Avenue

The Waldo Road and University Avenue intersection marks the principle intersection of East Gainesville, and one of the major intersections in the city as a whole. Despite this however, the area surrounding the intersection is home to liquor stores, fast food restaurants, run-down convenience stores, and abandoned buildings. An effort has taken place in the past few years to

revitalize East Gainesville, but this will likely be impossible without restoring this intersection to respectability and prominence. Given its proximity to the downtown, this intersection should develop as an urban TOD. The two major areas that were excluded from later development were a small cemetery and a section of former railroad right-of-way currently used as a trail. After these subtractions, a total of 100.2 acres remain available for redevelopment within the station area, allowing for a total of 3,006 units to be constructed at 30 units/acre. Figure 5-13 shows the parcels to be redeveloped around the Waldo Road and University Avenue station.

Twelfth Avenue and Waldo Road

Within the past several years the intersection of 12th Avenue and Waldo Road has become an area of controversy as civic leaders and community groups have battled over whether to encourage or block the construction of a Wal-Mart and its accompanying commercial strip development. In the end the development was approved (shown in Figure 5-7), and currently the development is in its later stages of development, likely making this area a focal point of activity for East Gainesville for the coming years. Though separated from the downtown and the University of Florida and lacking workers who commute to locations within this area, its urban location in an economically depressed area in need of redevelopment dictates that it be developed as a transitional TOD. The trailer parks and the Tacachale community for the developmentally disabled will present challenges to redevelopment, but the opportunity for the city to both encourage the supply of affordable housing and redevelop East Gainesville will hopefully be enough incentive to overcome these obstacles. Upon excluding the Martin Luther King Jr. Park and the rails-to-trails right-of-way, a total of 162.9 acres remain available for redevelopment within the station area, allowing for a total of 2,500 units to be constructed at 20 units/acre. Figure 5-14 shows the parcels to be redeveloped around the 12th Street and Waldo Road station.

Thirty-First Avenue and Waldo Road

The eastern most TOD on the Gainesville line, before the terminus at the Gainesville Regional Airport, the 31st Avenue and Waldo Road area is currently largely undeveloped (shown in Figure 5-8) with the exception of a discount store and a handful of storage facilities. Due to its remote location, this area should be developed as a suburban TOD. Parking should be provided at this location to facilitate a small amount of commuting from the communities of western Alachua County. After excluding the wetlands and nature preserve to the west of the proposed station, a total of 276.4 acres remain available for redevelopment within the station area, allowing for a total of 1,250 units to be constructed at 10 units/acre. Figure 5-15 shows the parcels to be redeveloped around the 31st Avenue and Waldo Road station.

Stations Not Designated as TODs

Three stations located along the proposed line are not designated as transit-oriented developments; however, development around these stations will likely occur. Moving from West to East, the first of these stations is located around the intersection of 18th Street and University. This station provides access to a concentration of University of Florida buildings, Ben Hill Griffith Stadium, the O'Connell Center, a variety of churches, and a strip of commercial service businesses. The surrounding residential development is a combination of older single family student housing and three to four story, limited parking apartments. Similarly, the second station not classified as a TOD located downtown at 1st Street and University Avenue is surrounded by a mix of historical residential and commercial structures, included a substantial portion which are currently at suitable densities and intensities for a light rail line. Given the limited redevelopment potential and the significant number of developments which would be complimentary to a light rail line, these two stations were not designated as TODs to save resources for other stations.

The final station not designated as a TOD is located near the terminal of the Gainesville Regional Airport on Waldo Road. Many travelers visiting the University and local businesses use the airport to enter the City, and the number of these passengers will continue to grow in the next fifty years. Without an automobile, these travelers will require fast transportation to and from their destination within the City, necessitating the linkage with the proposed light rail line. Though a station is needed, the location on the outskirts of town on airport property and the subsequent building restrictions associated with this are the principal reasons for not designating this station as a TOD.

Transportation and Housing Calculations

Table 5-1 shows the total acreage, density, and number of total units to be located at each of the seven TODs along the proposed Gainesville light rail line. Based on this scenario, a total of 11,135 rental housing units would be developed if the prescribed densities around each TOD are followed. Using the current average of 2.02 persons/household (U.S. Census Bureau, 2006), a possible 22,493 residents would be accommodated under such a plan. If Gainesville's population doubles by 2060, these developments would house 10.2% of Gainesville residents. Given the annual savings per household of $579 due to the reduction in automobile ownership, a total annual amount of $6,447,165 per year (in 2004 dollars) could be saved for households within the City of Gainesville under the 2060 light rail plan.

Factors That May Change the Conclusion

Given the long range time frame of this study and the variability of some of the measures from location to location, the conclusions of the affordability analysis for the Gainesville 2060 light rail alternative may be inaccurate if a series of assumptions are incorrect or conditions change dramatically in the next fifty years. As stated at the outset, this thesis set out to determine the affordability of housing and transportation strictly on a monetary basis rather than

on utility, which includes time. In a poorly performing rail system with long headways and slow travel speeds, the amount of time spent waiting may negate the monetary savings from not owning a car and living in a TOD. Commuters typically value commute time at half their hourly wage (Meyer and Miller, 2001).[25] Using local averages,[26] if the average household spent 14 minutes longer each day traveling in Gainesville under a light rail alternative than one of the other alternatives, the $579 average annual transportation and housing cost savings would be offset.

Home to one of the largest Universities in the country, Gainesville presents a unique college town demographic profile, which remains relatively unstudied in terms of both commuting and housing and transportation costs. Since many of these residents are dependent on their parents for income, many students may not give up their cars at the same rate as other cities that develop rail transit systems. Reconnecting America (2004) estimated a 44% drop in automobile ownership rates for residents within fixed guide-way transit zones; however, Pleasant Hill Station, while designed primarily as a park-and-ride, had a car ownership rate of 1.3 automobiles per household, only a 19% decrease below the national average. Given the suburban location and the automobile oriented design, this would be an unlikely result for Gainesville. If this did occur though, Gainesville residents living within TODs would experience a combined housing and transportation increase of $1,225.

Most significantly, the absence of a strong regulatory framework and/or government subsidization would result in only high income housing being constructed around light rail stations, leaving the poor to live outside of the station areas with fewer transportation options,

[25] Kockelman (1997) found that commute times were valued at $10/hour in 1989 dollars, or approximately $15.23 an hour in 2004 dollars.

[26] These averages include a median single-household, single-earner income of $28,371, 230 days of commute/work, a 40 hour work week, and two commute trips/day.

more isolated, and paying higher costs. This occurred in development directly adjacent to Mockingbird Station in Dallas, as only high-end loft style apartments were provided directly on-site. These high-end developments do not extend too far past the station boundary, though, allowing for a net decrease in housing and transportation costs for many residents. If a weak regulatory framework existed during implementation of the light rail line and governments did little to encourage rental units around TODs, the current trend of constructing only luxury condos around high traffic intersections may continue around TODs. If 90% of the units within the TODs are initially sold as condos and only 10% are initially rented, then a significant decrease in the number of low and middle income residents affected would occur.[27] Holding all other factors in the model the same, this would result in only 2,141 total units with increased affordability, or only 2.0% of the future city population.[28]

Several other occurrences threaten the conclusion of this study but are more difficult to quantify. One possibility involves a scenario in which savings are only passed on to the rich, and captive riders and low-income families end up receiving little or no savings because they already live either without an automobile or with the maximum reduction in the number of automobiles per household.[29] The different scenarios which may change the study's conclusion appear in Table 5-2.

[27] Many new condos are eventually rented out after purchase, but usually at a significantly inflated price removing them from the realm of affordability.

[28] Using a City of Gainesville 2060 population of 220,000 and the current average household size of 2.02 persons/household (U.S. Census Bureau, 2006)

[29] Captive riders are people who ride transit because they have no other choice. This is typically for economic reasons, i.e. they cannot afford to own a car.

Factors That May Affect, but Not Change the Conclusion

Several other variables and factors may affect the degree of the combined transportation and housing affordability in Gainesville but will not change the overall conclusion that transit-oriented developments reduce costs. A fuel price change or the use of alternative fuels may have some effect on the calculations, though the fixed cost of owning a car will likely strongly outweigh this change. With many analysts claiming that the world has reached its peak oil production, prices for gasoline will likely continue to increase for automobiles over the next several decades. Gasoline price increases affect personal automobile users disproportionately, since nearly all light rail transportation systems are powered by electricity. Unless an alternative to gasoline becomes widely available, automobile users may spend between five and ten dollars a gallon (in 2004 dollars) for gasoline by 2060. Without further transportation investments, this cost of fuel would add an additional cost of between $1,594 and $4,250 per household per year for Gainesville residents.[30] This would increase the annual transportation and housing savings for Gainesville TOD residents relative to non-TOD residents to between $2,173 and $4,829 per household per year.

A recession that delays the development around the light rail line may lower investor confidence in future projects once the market turns around, leading to densities around TODs that may never be fully realized. Even in the absence of a recession, these high densities required to sustain a light rail system may never be realized, as they only exist in a handful of large American cities. If densities were to only reach one half or one third of their prescribed amount, the proportion of Gainesville residents benefiting from reduced housing and

[30]This calculation uses the average of 21,250 vehicle miles traveled per household from the 2001 National Personal Travel Survey (Federal Highway Administration, 2004), the average December 2004 gasoline price in Florida of $2 per gallon (Energy Information Administration, 2008), and assumes an average gas mileage increase to 40 miles/gallon.

transportation costs would decrease proportionately. Using a worst case scenario where densities only reached one third of their intended amount, suburban TODs would develop at 3.3 units/acre, transitional TODs at 6.7 units/acre, and urban TODs at 10 units/acre. Holding the other factors in the model constant, only 3,710 households would experience increased affordability of housing and transportation using a low density redevelopment pattern. If Gainesville's population doubles by 2060 as predicted, only 3.4% of Gainesville residents would fit into this category.[31]

Recently, many cities have used sales tax to fund either proposed transit systems or bolster existing ones. Sales tax increases approved by referendum have occurred within the past several years in Kansas City, Missouri (3/8 cent), Salt Lake City, Utah (1/4 cent), and Ft. Worth, Texas (1/2 cent). Using the high value of a ½ cent increase to fund a system in Gainesville, and multiplying this by the percentage of median income used on sales-taxable goods,[32] each Gainesville household would pay an additional $56.40 per year to fund the system, reducing the combined savings of TOD residents to $522 on average. Since all residents of the City would be paying under this plan, the majority of Gainesville residents would be paying the tax without seeing a monetary benefit; however, the total savings for TOD residents of $5,812,470 outweighs the cost to non-TOD residents of $5,538,789.

Several other factors affect the degree of affordability but are not easily quantified. Transit system operating costs may increase significantly over current levels, and this cost may be passed on to the residents of Gainesville though fare increases or yearly fees paid by students

[31] Using a City of Gainesville 2060 population of 220,000 and the current average household size of 2.02 persons/household (U.S. Census Bureau, 2006)

[32] The breakdown of household spending used by Canby (2003) was used. Housing, Groceries, Insurance, Pensions, and Health Care were excluded since these are not taxed in Florida, leaving 36.6% of total median income from transportation, entertainment, apparel and services, and other.

with tuition. Increased parking costs downtown and around campus may also place an increased cost burden on non-transit users, leaving users of the transportation network who choose to drive with higher costs, which are only indirectly accounted for within the affordability calculations. One final area that may affect results deals with the economic affects on non-transit riders. Only a small body of research within the last hundred years has focused on citywide rent and property value changes in cities with new rail systems. A positive overall effect on rents due to economic stimulus or a negative effect on rents outside the station area due to economic redistribution may have a considerable effect on the results of this study. Under a scenario in which light rail systems only serve to redistribute wealth rather than create it, a net savings of approximately $33 for residents outside of TODs would be absorbed, as the equal and opposite amount of rent premiums experienced around TODs are redistributed to the rest of the community. The different scenarios which may affect, but not change, the conclusion of this study are listed in Table 5-2.

Gainesville Conclusion

At an October, 2007 meeting of the Gainesville Metropolitan Transportation Planning Organization discussing the 2060 long range transportation plan, Commissioner Ed Braddy suggested that, among other things, a light rail system within Gainesville would create a significant barrier to affordable housing. Commissioner Braddy used the comparison of the price of a suburban three-bedroom home in Houston to a two-bedroom flat in Portland as an example to prove his point. While Braddy's argument may be muddied by the fact that both locations now contain successful light rail systems, it can be assumed that the point he was trying to make was that cities that densify around transit are far more expensive than those that sprawl outward around highways and arterials. While in previous statements at this same meeting, Mr. Braddy acknowledged a connection between housing and transportation, his suggestions of ballooning

mortgages and residential rents failed to define affordability as a function of both transportation and land use. The previous research, along with the case studies in this report, dispute any definitive claim of rising costs when combining housing and transportation on a square footage basis.

While there appears to be a significant portion of this thesis dedicated to chronicling Commissioner Braddy's statements, a broader purpose exists than purely settling a personal disagreement. Mr. Braddy represents not only a constituency within the City of Gainesville, but a larger ideological position which must be persuaded by the conclusion of this study and others to change their position on this topic in order to achieve the maximum possible support from the public. Many conservative and libertarian public policy institutes have yet to be convinced of the efficacy of the new age of passenger rail transportation and their criticisms must be addressed in order to fully inform the citizens of communities across the country.

Within the City of Gainesville, a light rail system with an aggressive accompanying TOD policy appears to contradict the assertion of drastically higher costs associated by some with light rail systems. Using the assumptions detailed in this report, the proposed system generates a significant cost savings for the renters living within walking distance of the station. Critics of this study may disagree with the many assumptions used to construct this model and may use these as reasons to dismiss the overall conclusions of this study. While changes in several of the assumptions may produce a somewhat different result, the conclusion will most likely remain the same barring circumstances which defy current norms. Developing a concrete conclusion from such a long term study remains extremely difficult; however, the results of this study should form a starting point from which a debate may occur as to whether a light rail system in Gainesville in the next fifty years will decrease or increases combined housing and transportation

costs for low and middle income residents. As a result of this thesis, this starting point will hopefully differ substantially from that proposed by Commissioner Braddy at the October 11, 2007 meeting of the Gainesville MTPO.

Figure 5-2: Oaks Mall and NFRMC Current Conditions

Figure 5-3: Forty-Third Street and Newberry Road Current Conditions

Figure 5-4: Thirty-Fourth Street and University Ave Current Conditions


Figure 5-5: Thirteenth Street and University Avenue Current Conditions

Figure 5-6: Waldo Road and University Avenue Current Conditions

Figure 5-7: Twelfth Avenue and Waldo Road Current Conditions


Figure 5-8: Thirty-First Avenue and Waldo Road Current Conditions

Figure 5-9: Parcel Analysis for the Oaks Mall and North Florida Regional Medical Center Suburban TOD

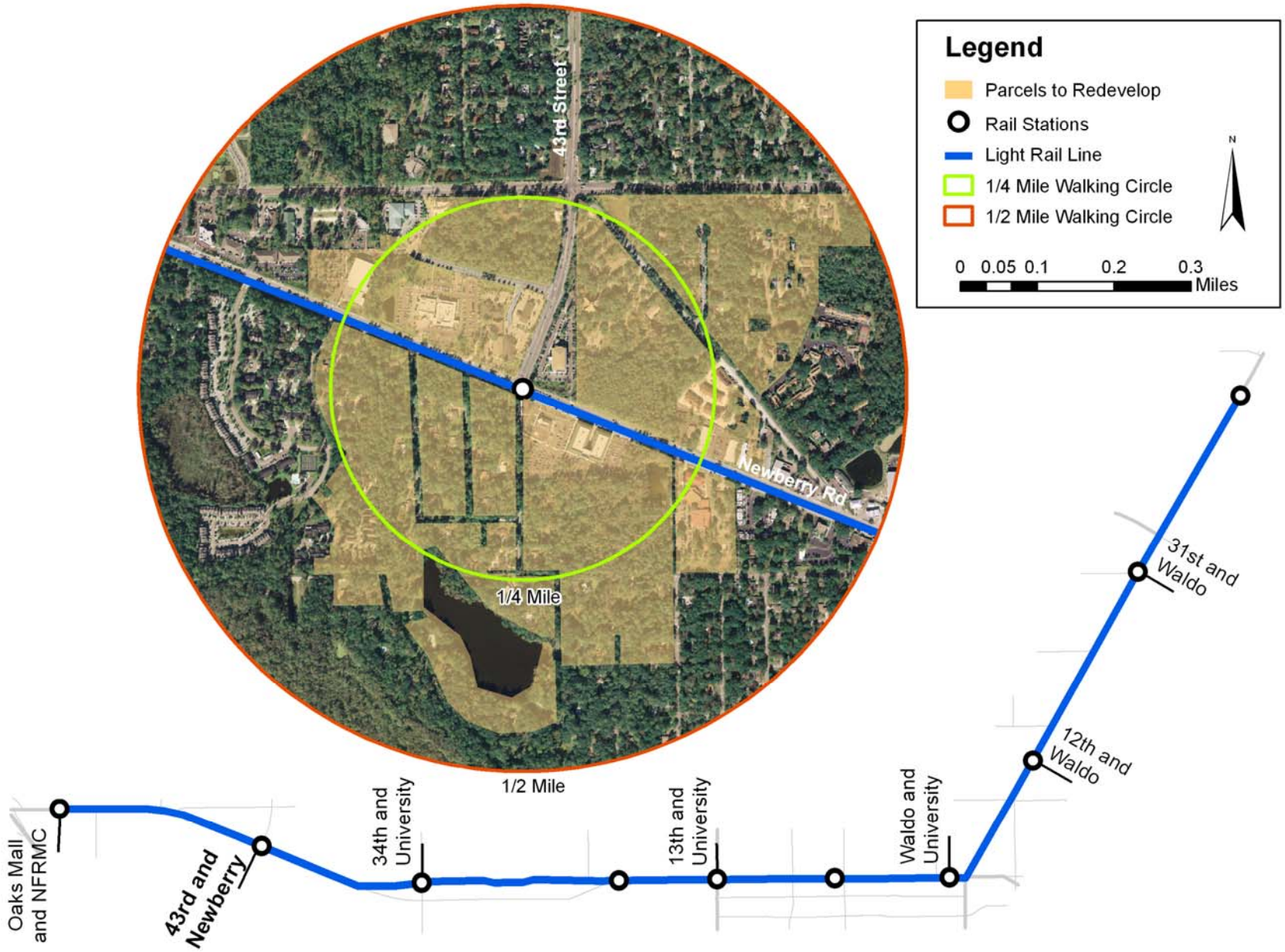

Figure 5-10: Parcel Analysis for the Forty-Third Street and Newberry Road Transitional TOD

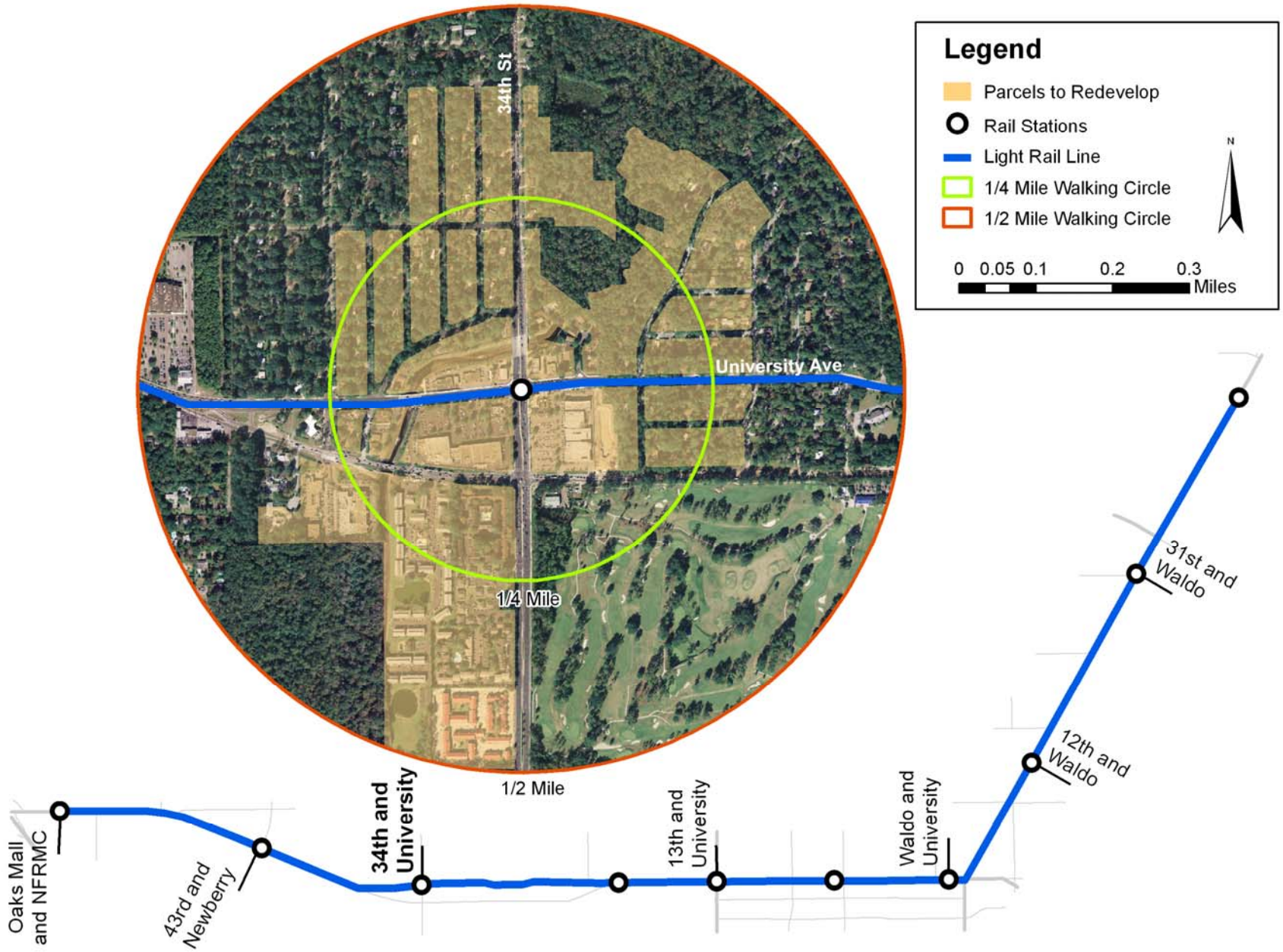

Figure 5-11: Parcel Analysis for the Thirty-Fourth Street and University Avenue Urban TOD

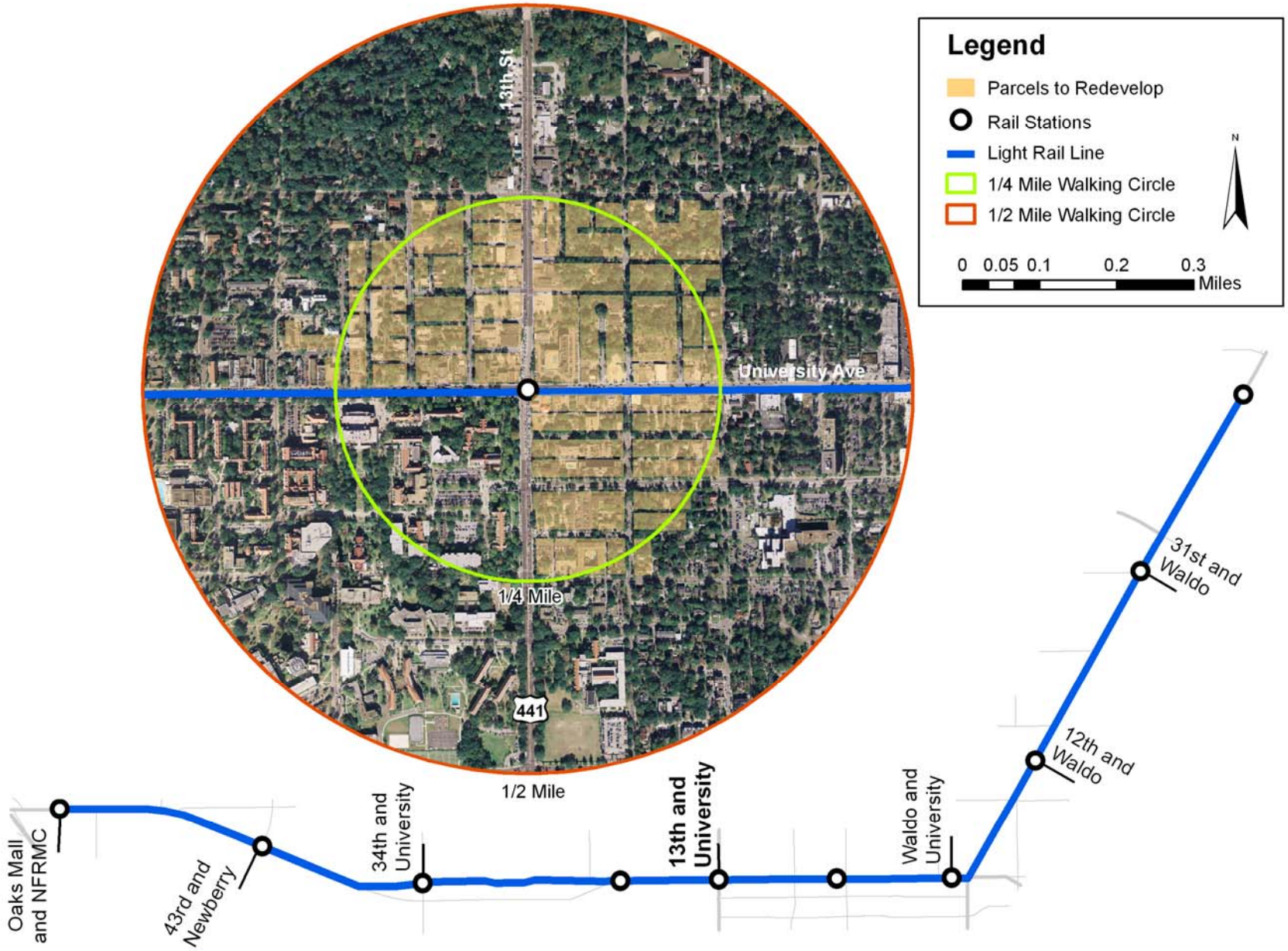

Figure 5-12: Parcel Analysis for the Thirteenth Street and University Avenue Urban TOD

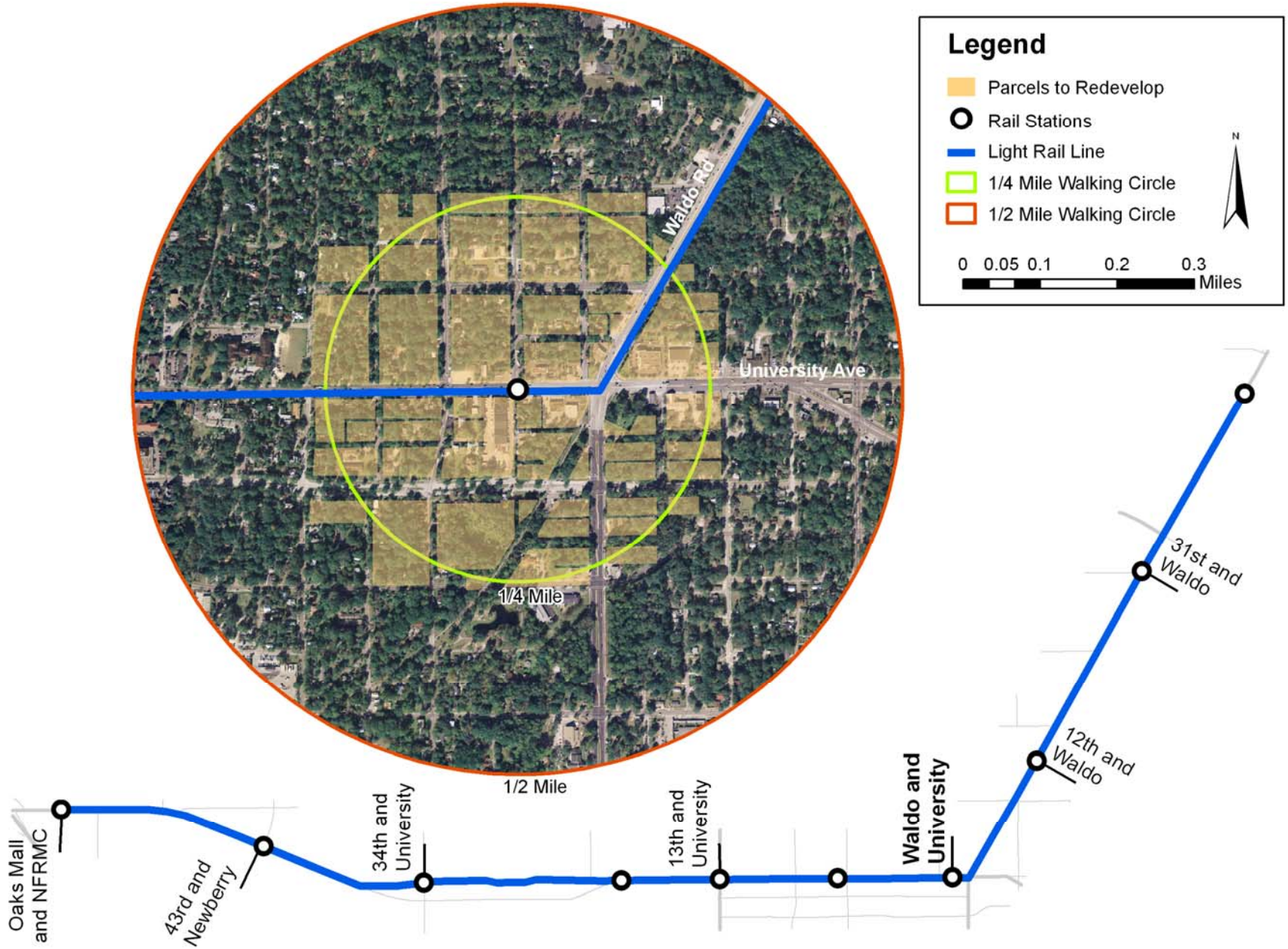

Figure 5-13: Parcel Analysis for the Waldo Road and University Avenue Urban TOD

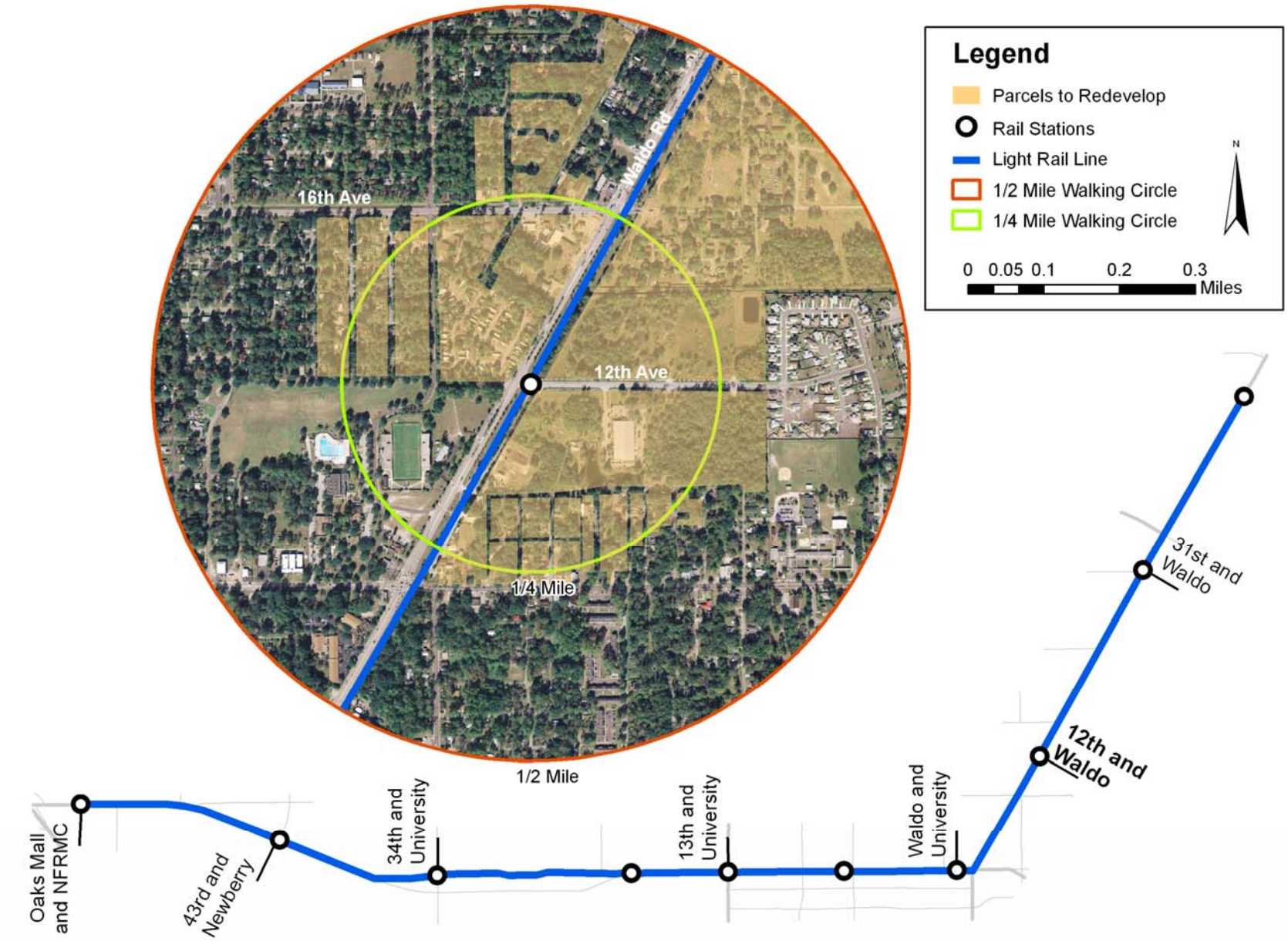

Figure 5-14: Parcel Analysis for the Twelfth Avenue and Waldo Road Transitional TOD

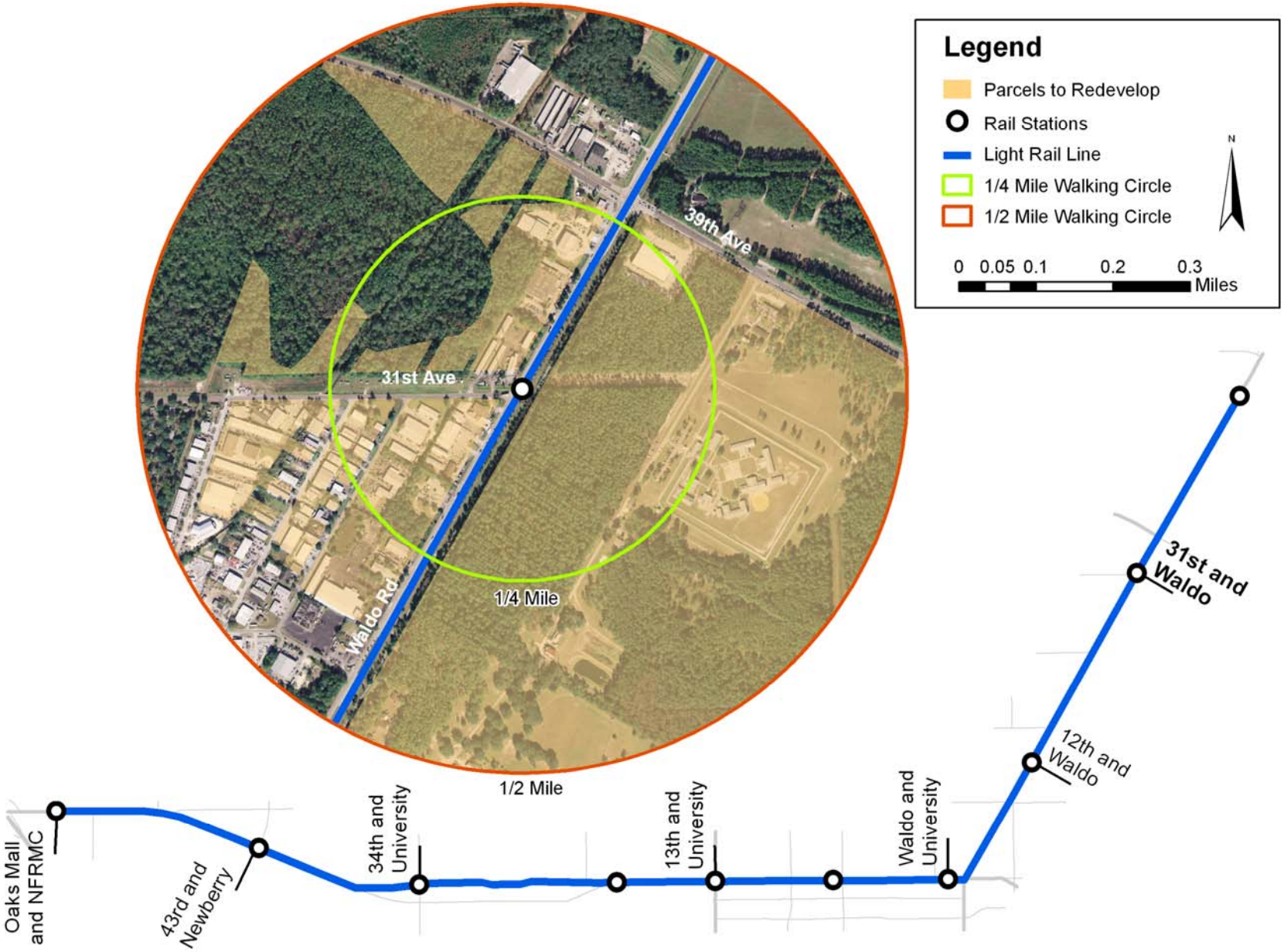

Figure 5-15: Parcel Analysis for the Thirty-First Avenue and Waldo Road Suburban TOD

Table 5-1: TOD Developmental Totals

Transit Oriented Development	Land for Redevelopment (Acres)	Developmental Density (Units/Acre)	Total Units	Rental Units
Oaks Mall and N.F.R.M.C.	160.0	10	1,600	832
43rd St. and Newberry Rd.	184.9	20	3,698	1,923
34th St. and University Ave.	158.6	30	4,758	2,474
13th St. and Newberry Rd.	77.7	30	2,330	1,212
Waldo Rd. and University Ave.	100.2	30	3,006	1,563
12th St. and Waldo Rd.	162.9	20	3,258	1,694
31st Ave. and Waldo Rd.	276.4	10	2,764	1,437
		Totals:	21,414	11,135

Table 5-2: Factors that May Change the Conclusion

Factor	Change	Cause	Result
Travel Time	Increase of 14 minutes per household per day	Poorly managed or under-funded system	No net housing and transportation savings for TOD residents
Automobile Ownership	Decrease of only 19% with TODs (compared with 44%)	Poor TOD design or inelasticity of automobile ownership in college towns	Annual housing and transportation costs increase for households within TODs by $1,225 annually
Percentage of Renters	Only 10% of new TOD housing units are rentals	Weak regulatory framework leads to the construction of mostly luxury condominiums within TODs	Only 2.0% of the entire future population is affected under such a plan (a decrease of 8.2%)
Unequal distribution of savings	(not available)	Only higher income households have decreases in auto ownership since poor households already own as few vehicles as possible (captive rider problem)	Regressive system where relative savings increases with income (exact numbers not available)

Table 5-3: Factors that May Affect the Result, but Do Not Change the Conclusion

Factor	Change	Cause	Result
Fuel Price	Increase in the cost of gasoline to between five and ten dollars per gallon	Resource limitation and slow development of new technologies	Transportation and housing savings for TOD households of between $2,173 and $4,829 annually
Density	Densities at each type of TOD only reach one third of their intended value	A recession or a lack of market demand	Only 3.4% of city residents would receive increased housing and transportation affordability (a reduction of 6.8%)
Transit Operating Cost	Increase (exact increase not available)	Increased relative energy costs	Decreased combined housing and transportation cost savings (exact decrease not available)
Area-wide Rents	Overall, rent premiums are negated since their increase in one area leads to an equal and opposite decrease elsewhere	Light rail doesn't function as economic stimulus, but rather as economic redistribution	Average annual savings of approximately $29 for households outside of TODs
Parking Costs	Increase (exact increase not available)	Increased demand and regulation	A progressive fee which would disproportionately affect the wealthy and have a lesser effect on renters (exact cost not available)
Sales Tax	Increase in sales tax of half a cent to pay for the costs of constructing and operating the transit system	Lack of state and federal subsidy for the transit system	All households in Gainesville would pay approximately $57 more per month, while decreasing the annual savings per household with TODs to $522.
Rent Premium	Rent Premium of only 10%	Landlords place less value on rail transit access	A rent premium for TOD households of only $788 and a total annual savings of $1,320 per household

CHAPTER 6
CONCLUSIONS AND FURTHER RESEARCH RECOMMENDATIONS

Conclusion

The conventional development pattern of the modern era has become increasingly less accepted over the past several decades. Cost-burdened municipalities with escalating amounts of infrastructure to maintain and their residents, who once moved to the suburbs for open space and healthy living but are being crammed onto increasingly smaller lots and becoming increasingly overweight, are looking for a change. While the personal transportation vehicle is here to stay, a reinvestment in public transit is one solution which appears to be growing increasing favor among all levels of government as rail systems have been proposed all across the county in the last several decades. A comprehensive planning approach encouraging a dense, town-centered development pattern has become a complimentary policy to many of these new rail projects. These developments, known as TODs, have the possible benefit of returning the focus of cities across the country to downtowns and mixed-use activity centers and limiting the unsustainable, and increasingly unwanted, sprawling land use pattern which has arisen in the United States over the last sixty years.

Besides reducing sprawl, TODs have the ability to provide more affordable living for station area residents when considering combined housing and transportation costs. Successful TODs have been proven to significantly reduce automobile ownership, which currently accounts for nearly $6,000 of the annual budget for the average American. While transportation costs are lowered with TODs, housing costs have been shown to significantly increase due to rent premiums around transit stations, which typically account for around a 20% increase in rent. The balance between these two factors appears to form the barometer of affordability for TOD residents.

Within Gainesville and around the country, the ultimate test of TODs at providing more affordable housing and transportation will be whether these developments and the rail lines that connect them, combined with comprehensive planning policies, will be enough to encourage a variety of housing stock and businesses to relocate at a medium to high density around the stations. If, through government policies and market forces, complementary land use changes occur around light rail lines, residents of TODs in Gainesville and other metropolitan areas that employ an effective strategy may view the automobile as an amenity rather than a necessity. If this occurs, many low and middle income residents will be relieved of the significant cost burden associated with compulsory automobile ownership, and the community as a whole will receive a net benefit and a significant savings in terms of combined housing and transportation costs.

A variety of techniques such as public/private partnerships, land use regulations, developer incentives, and government subsidization must be used to ensure that a proportionate share of the housing stock within TODs is affordable to those employed in lower paying jobs. For transportation systems to be affordable, from both the government and the citizens' perspective, a shift of focus must occur from a series of widely spaced, arterials to a more tightly spaced interconnected grid system around light rail lines and stations. Refocusing the transportation infrastructure this way in Gainesville and throughout the country will be a difficult task that will require cooperation and a common vision among local, state, and federal transportation agencies.

During the October 11th meeting of the Gainesville MTPO, Commissioner Braddy noted that any long term transportation alternative should be judged on its ability to promote social welfare, using the definition of Winston and Maheshri (2006) as the "demand for and cost of [light rail] service" (pg. 363). This report proposes a much different definition of social welfare that includes the net housing and transportation costs low and middle income residents. Under

this definition, and using the factors and assumptions outlined in this report, a light rail alternative for Gainesville measurably increases social welfare, as combined housing and transportation costs decrease for renting households of TODs in Gainesville by over $500 per year, with over 10,000 households affected. While this document is not meant to end the debate on the social welfare or affordability of light rail systems, it will hopefully be added to the list of resources for making an informed decision on light rail systems when considering affordability as a function of both housing and transportation.

Further Research Recommendations

Currently, a lack of research exists on how housing prices are affected, not just along rail lines, but regionally by the location of new rail lines in urban areas. Does the location of light rail have a regenerative or a redistributive effect on housing prices? If the effect is merely redistributive, then the cumulative effect on affordability of housing and transportation within the region must always be positive presuming that the rail line is reasonably priced and adds additional public transit accessibility. If the effect is regenerative, this may provide an added incentive to business and city leaders attempting to spur economic development. If the effect is redistributive, then the whole community may benefit in terms of housing and transportation affordability upon the investment in a rail system.

Relating specifically to Gainesville in 2060, further research is needed to determine both the forecasted ridership using transportation modeling software and the estimated cost of constructing such a system. More study and more experience are also needed with the various forms of inclusionary zoning policy adopted at TODs around the country to determine which structure and system would work best within Gainesville. The inclusion and effectiveness of these policies will likely dictate whether affordable and market rate units are built within TODs.

These housing units will be reserved for households that may already not own a car, yet still not be able to afford housing within proximity to a light rail station.

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