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Light Rail Transit Impacts in Portland: The First Ten Years

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Abstract

This paper examines how the first decade of light rail transit (LRT) in the Portland region has affected auto ownership, mode share, density, and property values. The empirical analysis provides evidence that light rail has had some positive effect of rail on single-family property values, transit use, and slower growth of two-plus car households in the outer part of the LRT corridor as compared to an outer part of a parallel bus corridor. These effects may be the result of households self-selecting to make housing location decisions where LRT is located, rather than current households changing mode.

This assessment of the evidence indicates the extent to which consumer preferences have responded to LRT investments. This kind of assessment is needed to provide the basis for estimating travel mode shares and market shares for dispersed and concentrated development forms. Examination of data suggests that it may be advisable for planners to entertain more modest expectations of LRT.

Key words: Transit-oriented development, Light Rail Transit impacts

Introduction

This paper examines how early light rail transit (LRT) in Portland, Oregon, has affected travel mode, auto ownership, residential density, and property values. The effects of Portland's first line, which began operating in 1986, have been modest; more developmental impacts are expected on a newer second line that opened in 1998 in the rapidly growing westside area. This examination of travel behavior and land use effects of early LRT in Portland lays a foundation for future exploration of the potential for the transit-oriented development concept.

In the Portland region many local planners have embraced the concept of transit-oriented development (TOD). One of the primary components of transit-oriented development has been in place in Portland long enough to provide data for analysis, although the 1986 LRT line that is the subject of this study was not accompanied by many of the transit-supportive elements recommended by planners today.

The Limitations of Transportation-Oriented Development and Efforts at Evaluation

Audirac and Shermyen (1994) characterize the New Urbanism as a postmodern reconstruction of American suburbia that goes by various names: "pedestrian pockets" on the West Coast, "urban villages" in the Northeast, and "neotraditional neighborhoods" in Florida. A common element is the pedestrian-friendly street and mixed-use town center. The transit-oriented development (TOD) variation includes transit corridors and mixed-use, high-density development around transit stations. From a transportation perspective, the value of transit-oriented design is predicated on the assumption that TODs generate shorter trips, less traffic, higher transit rates, and a better jobs-housing balance.

The TOD concept is conducive to walking and transit, as Bernick and Cervero (1997) describe in their formulation of the "transit village:"

> [T]he transit village is a compact, mixed-use community, centered around the transit station that, by design, invites residents, workers, and shoppers to drive their cars less and ride mass transit more…. Transit villages also offer alternative living and working environments that combine the suburban values and lifestyle preferences for open space, human-scale buildings, and sense of security with the more traditionally urban values of walking to neighborhood shops, meeting people on the street, and being in a culturally diverse setting (pp. 5,7).

Bernick and Cervero acknowledge observers skeptical about TODs, who critique them as "'boutique' design and planning concepts; underneath the physical facade, there are few transportation benefits to be found" (p. 131). However, Bernick and Cervero respond by saying that these critics accept "the current settlement patterns and pricing arrangements" (p. 132). Therefore, their transit village concept is part of a larger package that includes pricing the automobile - a package whose benefits, they maintain, may not be apparent until the long term.

Martin Wachs, as quoted in Bernick and Cervero (p. 267), points out that " . . . a niche market is likely to exist for compact, mixed-use neighborhoods around rail stations . . . [but] all the forces pulling development to outlying areas over the past 10 years are still with us." Crane (1998) finds that there is little consensus about how urban development patterns influence travel patterns. He concludes that the evidence is mixed and that "the potential benefits of new urbanism reflect an interesting set of hypotheses, but they remain a weak basis for ... transportation policy" (p. 2).

The expectation that TODs will reduce auto travel and increase use of alternative modes is based on research comparing traditional and suburban neighborhoods (Friedman, Gordon and Peers 1994), but without controls for demographic and density differences in older traditional neighborhoods and suburban ones. Subsequently, Frank and Pivo (1994) controlled for density and found that trip rates and mode choice effects occur at densities higher than only 13 dwelling units per acre. Also, Cervero and Gorham (1995) compared single-family paired transit neighborhoods and auto neighborhoods, as distinguished by transit access and gridded versus random street patterns, and found that neighborhood type was a significant predictor of mode choice, when holding density and income constant. They found that 1.4 percent more work trips are likely to be by transit in a transit neighborhood than in an auto neighborhood in the Los Angeles paired neighborhoods and 5.1 percent more in the San Francisco paired neighborhoods. Even at low densities, Cervero and Gorham found a density effect: a 2- to 4-percent increase in work trips by transit for a one-dwelling-per-acre increase in density.

The results are difficult to compare for a variety of reasons. For instance Cervero and Gorham use net residential density and extrapolate the results beyond the range of the data used to estimate the model, and Frank and Pivo use gross residential density and do not control for the nonlinearity of density. Nevertheless, there does appear to be a small effect of neighborhood type and density. The question of importance here is how that small effect might translate into transit ridership and reduction of auto use.

This study cannot answer the many questions surrounding the debate around TOD investment. It can, however, shed some light on the nature of the existing market for what is unarguably the most expensive element of that investment: LRT. Bernick and Cervero's work on the transit village assumes that LRT is supported by elements such as automobile pricing and high-density, mixed-use development. The ideal scenario in which Bernick and Cervero envision the transit village does not exist, although individual elements do. It is difficult, therefore, to assess the effectiveness of the full TOD concept empirically. This study can assess only the LRT component, without auto pricing or significant transit-oriented design. It also can assess only a limited timespan of LRT operation. This study can, however, provide a foundation for future work that builds upon the present findings.

Context for the Portland Case Study

The motivation for Portland's eastside LRT line in the 1980s stemmed from an earlier freeway revolt and federal legislation allowing for the substitute of transit for highways. However, transit-oriented development was not a central part of the project, although there was some station-area planning in the LRT corridor. This took the form of densification via redevelopment of low-density areas. However, due to a poor regional economy in the early 1980s and a shift of growth from the eastern part of the region to the western, this effort did not result in true transit-oriented design, as envisioned by Bernick and Cervero.

The residual effect on the east side was on upzoning of land around light rail stations. With a greater amount of vacant land and a stronger development market, planning for the westside LRT line focuses more on transit-oriented development. The planning and the birth of the New Urbanism movement and the refinement of the TOD concept coincides with construction of the westside LRT line. Like Bernick and Cerveros's "pearls on a necklace" notion, the transit station areas are being planned as points of mixed use with fairly high densities.

As a result of its history, Portland is an area where most local planners have embraced the TOD planning concept. Unlike the case in many metropolitan areas, decision-makers in the Portland region have achieved a remarkable amount of consensus about the connection between land use and transportation and their vision for the future. The regional planning entity, Metro, has devised a plan called Region 2040, which has been strongly influenced by a planning analysis spearheaded by 1000 Friends of Oregon, a land use watchdog organization. This analysis, known as LUTRAQ (Land Use Transportation Air Quality), has as one of its chief goals the reduction of single-occupancy vehicular (SOV) travel. At its core is growth management based on neotraditional design, supplemented with varying degrees of reliance on transportation demand management (TDM), including transportation pricing.

The Region 2040 plan was developed within the framework of Oregon's statewide planning program that stresses compact development and urban growth boundaries to curb urban sprawl and protect rural lands. The Region 2040 plan relies on light rail to focus development in mixed use centers.

There is no doubt that both the LUTRAQ and Region 2040 proposals are unique and ground breaking in ambition and that the planning process in the Portland metropolitan region is fascinating to study. This area is a fertile laboratory for analysis. However, outside observers often remark that Portland initiatives do not transfer to other locations. Even within Portland, it is unclear whether recent transportation investments will yield the results their supporters hope for. What if light rail is not effective? What if developers do not seize upon planning recommendations to build higher density TODs? And if they do build, what if people don't buy? And, if people do buy, what if they don't increase their use of mass transit? What if SOV use continues to increase? These are just some of the questions that point to the need to examine the impacts of older LRT investments.

Transit ridership in Portland tracks the economy and population growth, increasing from 130,600 average daily riders in 1981 (with a decline to 115,6000 in 1986 due to an economic recession and service cutbacks) to 198,400 in 1994. Overall transportation trends in Portland have mirrored those nationwide. A comparison of 1980 and 1990 census data (Pisarski 1992) found that during that period commuter behavior in the Portland area was "a model of the national trend.... Transit declines in the city of Portland itself were particularly marked with shares dropping from 15.9 percent to 10.9 percent. Only working at home and driving alone showed significant gains in shares. . . . Portland was one of the cities in which driving alone increased more than the increase in workers" (p. 27). Thus, while transit ridership in Portland may be increasing, shares are not necessarily increasing. Regionally, Portland's share of work trips by transit fell 34 percent between 1980 and 1990.

These are the recent trends, but future trends, as modeled in the LUTRAQ analysis, may show no real decrease in SOV share. Recent research by Giuliano (1995) questions the transportation-land use connection suggested by LUTRAQ. Her analysis of the LUTRAQ modeling projections is that "land use policies appear to have little impact on travel outcomes; most of the observed change is due to TDM [transportation demand management] policies, rather than to the land use and transit policies. Without TDM, travel impacts of the LUTRAQ alternative are minor" (p. 8).

In other words, transit incentives and transit-oriented design may have a negligible impact on SOV use. These strategies need to be part of a larger travel demand management package that includes auto disincentives.

Methodology

This study uses the ex post facto multiple-group pretest-posttest design (Spector 1981). The treatment group is that part of the study area that is in Portland's eastside LRT corridor. The control group is a parallel bus corridor considered sufficiently comparable. Before and after data are used in each corridor to measure travel behavior changes. The multiple-group analysis is superior to sole reliance on a pretest-posttest design, although ex post facto assignment (since observations obviously can't be randomly assigned to groups) raises self-selection as a potential threat to validity.

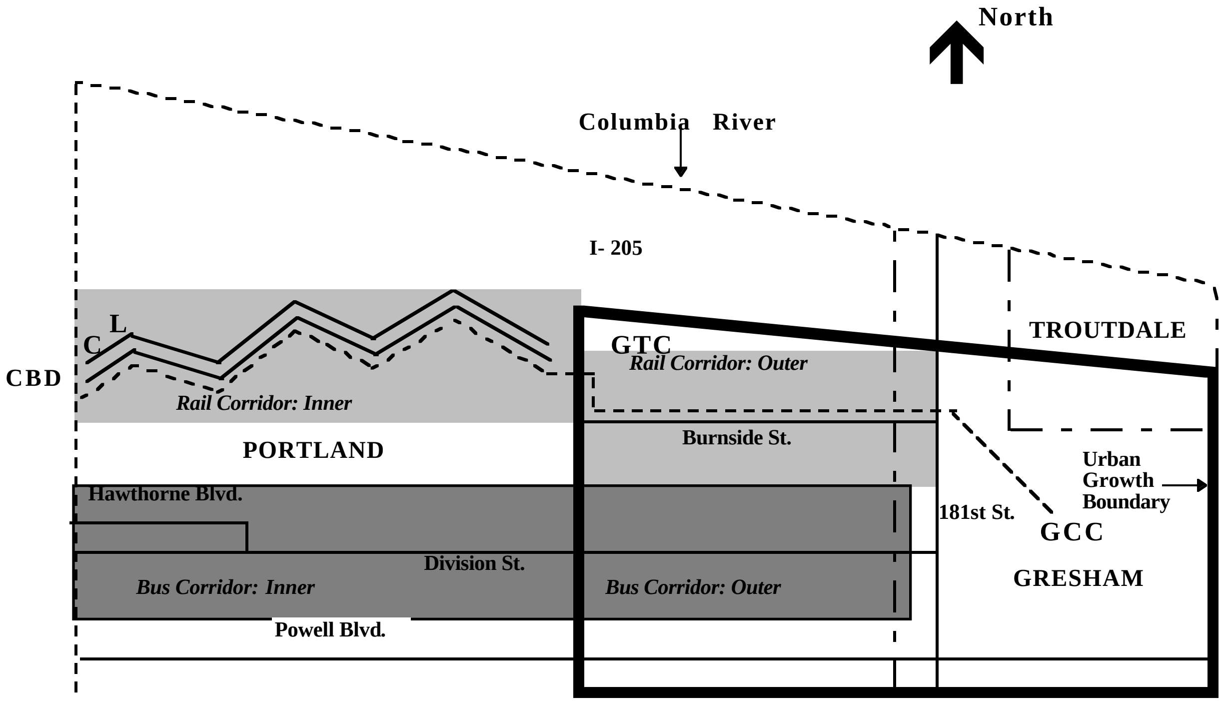
The pre and post periods are census years 1980 and 1990, with the 1986 opening date of the eastside LRT in the middle as the study's treatment. 1996 data from the dress rehearsal of the American Community Survey provide an additional point of time-series data for some variables (mode choice and auto ownership).

The primary study area (see Map 1) includes the rail corridor, the inner portion paralleling the Banfield Freeway (I-84) and the outer portion paralleling Burnside Street; and the bus corridor, the inner portion served by the Hawthorne and Division bus routes, and the outer portion by the Division and Powell bus routes. The rail and bus corridors are similar in land use and demography. The residential, commercial and industrial mix is shown in Table 1. The chief difference is that the rail corridor contains both LRT and an interstate freeway, I-84. The portion of Portland between the Willamette River and Interstate-205 consists of the built-out inner city area, where there is very little vacant land to develop. The outer parts of both corridors are suburban in character.

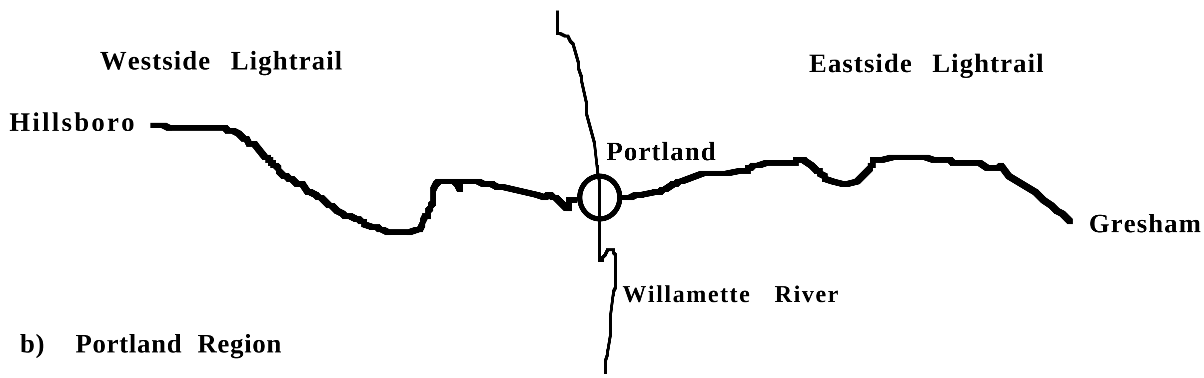
Table 1: Comparison of Corridors.

Characteristic	Corridor			
	Rail		Bus	
	Acres	Percent	Acres	Percent
Zoning of Land[1]				
Commercial	1302	15.4	770	9.5
Industrial	530	6.3	884	10.9
Multi-family Resid.	1659	19.6	1351	16.7
Single-family Resid.	4151	49.1	4591	56.9
Public Open Space & Other	805	9.5	473	5.9
Total	8447	100	8069	100
	Housing Units	Percent	Housing Units	Percent
Housing				
Tenure[2]				
Owner-Occupied	16,929	51.8	17,283	51.9
Renter-Occupied	15,784	48.2	15,989	48.1
Total	32,713	100	33,272	100
	Housing Units	Dollars	Housing Units	Dollars
SF Resid. Mean Value[2]	18,872	$140,207	19,617	$128,855
Median Family Income[2]	32,713	$33,057	33,272	$30,462

[1] Source: Regional Land Information System (RLIS) 1998 edition.
[2] Source: American Community Survey (ACS), 1996 Multnomah County Dress Rehearsal



a) Eastside Bus and Rail Corridors: Inner and Outer



b) Portland Region

Multifamily Housing Study Area	City Boundary	C	Convention Center
Rail Corridor	Light Rail Line	L	Lloyd Center District
Bus Corridor	I-84	GTC	Gateway Transit Center
	Major River	GCC	Gresham Civic Center

Map 1: Study Areas

The multifamily housing analysis is limited to the outer portion of the two corridors. This secondary study area is defined by I-84 to the north and I-205 to the west; the eastern limits of Gresham and Troutdale (the eastern part of the Portland Metropolitan Urban Growth Boundary); and a southern boundary extending one quarter mile south of Powell Boulevard.

Findings of Rail and Bus Corridor Impact Assessment

Housing impacts are assessed by comparing the rail corridor to the parallel bus corridor in two ways: location of multifamily dwellings and density changes. In addition, single-family price effects around suburban rail stations were statistically analyzed. Travel behavior effects were assessed by comparing the two corridors in terms of changes in auto ownership, transit use, and journey-to-work differences.

Changes with Respect to Transit Level of Service

The introduction of light rail in the Banfield corridor resulted in the elimination of one of four radial bus routes operating on arterials and two express bus routes operating on the Banfield Freeway. Feeder routes to rail stations, principally the Gateway Transit Center at the boundary between the inner and outer portions of the corridor, were added. In addition, both the inner portions of the rail corridor and the parallel bus corridor were impacted equally by cross-town bus improvements in the early 1980s. The net effect was an increase in seat-miles of transit service in the rail corridor as compared to the Division bus corridor.

Results with Respect to Multifamily Housing Development

This aspect of the study is concerned with densification in the form of multifamily housing development by level of transportation access. Access is determined by use of a quarter-mile buffer around light rail stops, bus stops, and major arterials. The model employs the concept of nesting, with each individual parcel having a specific level of transportation access.[3] Levels of transportation access are defined as follows:

- **rail stations** sites within 1/4 mile of rail stops, bus stops, and major arterials
- **bus stops** sites within 1/4 mile of bus stops and major arterials
- **arterials** sites within 1/4 mile of major arterials, but not bus stops or rail stops
- **other** sites are not within 1/4 mile of major arterials, rail stops, or bus stops

[3] The nested model works remarkably well with respect to inclusiveness. The only inconsistency concerns the bus stop coverage, which contains a few fragments that do not precisely overlap with arterials. The amount of this error is approximately 3%. The analysis utilized data from Regional Land Information System (RLIS 1996 edition), Metro, Portland, OR. ArcView was used to buffer transit stops and arterials to determine the transit locational typology of multifamily housing built during the 1986-1995 period.

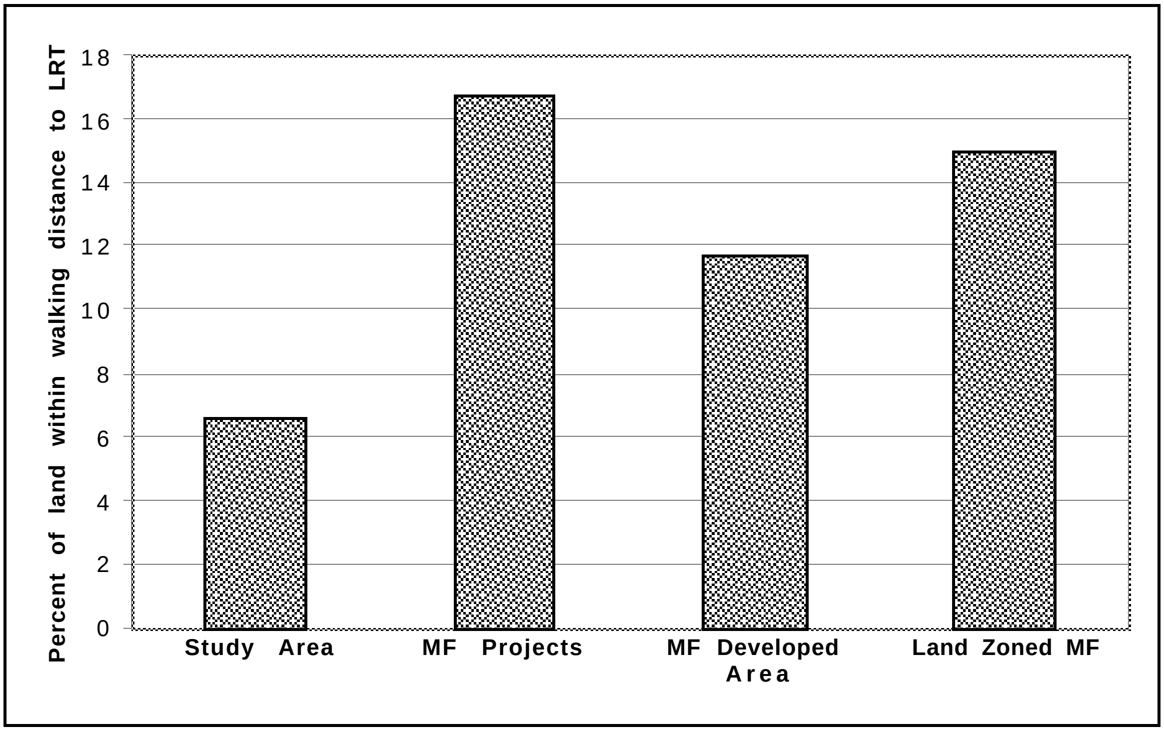


Figure 1: Rail Access. Walking distance to LRT stations (1/4 mi. buffer) includes 7 percent of study area. Seventeen percent of multifamily (MF) development projects since 1986 occurred within walking distance to LRT. Twelve percent of total developed MF acreage, 1986 - 1995, occurred within walking distance to LRT. Fifteen percent of land zoned for MF development is within walking distance of LRT.

Figure 1 shows that about 17 percent of all multifamily development projects built in 1986 -- the year light-rail opened -- through 1995, and 12 percent of the total amount of developed multifamily area in that 10-year period has occurred around rail stations. This would seem to indicate a higher rate of developed multifamily projects relative to the percentage of area around rail stations (7 percent). This higher rate should be considered, however, in light of the fact that station areas are more heavily zoned for multifamily housing development than other areas in an effort to densify rail-accessible areas. Figure 1 also shows that 15 percent of the land zoned for multifamily housing is in rail station areas.[4]

The number of vacant parcels zoned for multifamily housing in 1995 and the number of parcels of multifamily housing parcels that were developed between 1986 and 1995 are combined. Together this reflects the number of parcels available for multifamily housing in 1986. Similarly, the area of vacant land zoned for multifamily housing in 1995, and the area of multifamily housing parcels that were developed between 1986 and 1995 are combined. The results show that the build-out rate for parcels located in rail station areas is lower than in areas served by bus stops and arterials. Controlling for available multifamily land, the build-out rate for rail station areas is less, as shown in Figure 2.

[4] Tables from which figures included in the paper can be found in Dueker and Bianco (1998), with the exception of the 1996 ACS data, which were developed for this paper.

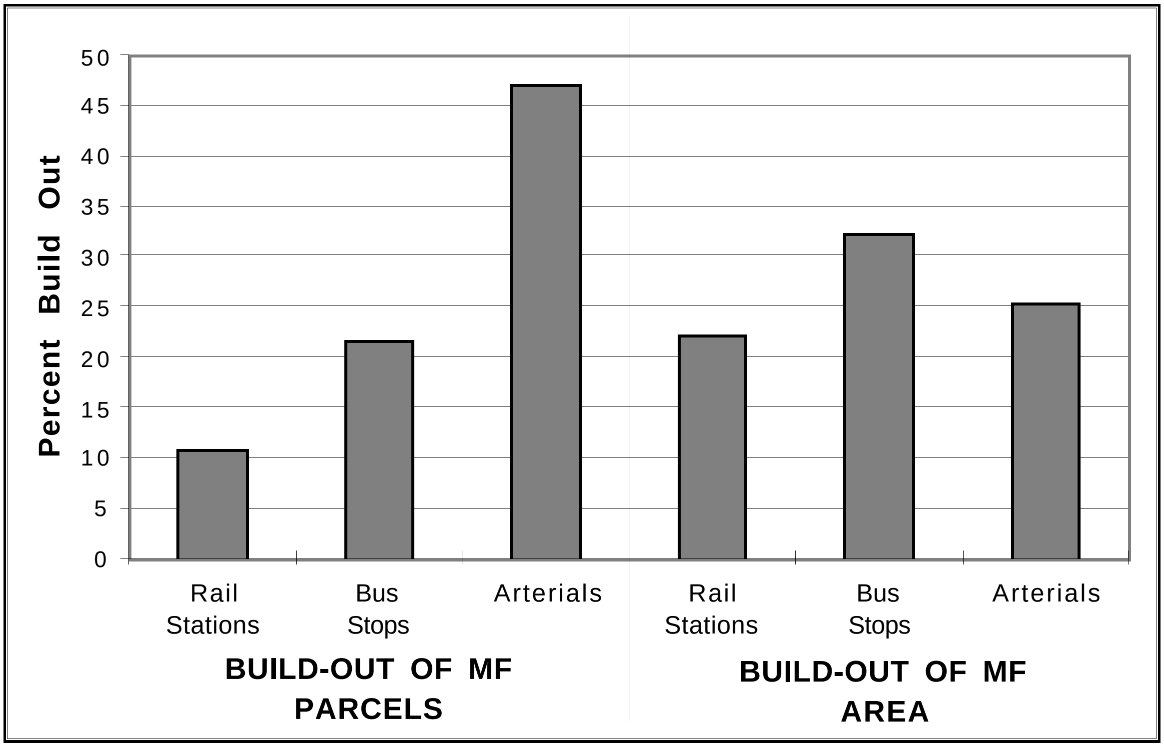


Figure 2: Build-out rate controlling for availability of MF parcels/area. Number of parcels/area developed for MF housing 1986 - 1995 as a percentage of parcels/area zoned MF and vacant, and zoned MF and developed for MF housing 1986 - 1995, by type of transportation access. Ten percent of the MF zoned and vacant parcels around rail stations have been developed during the 1986 - 1995 period, while 21 percent of MF zoned and vacant parcels around bus stops have been developed. Twenty-two percent of MF zoned and vacant acres around rail stations have been developed and 32 percent of MF zoned and vacant acres around bus stops have been developed.

This analysis indicates that while multifamily development is occurring more rapidly near rail station areas than elsewhere, this may be due more to the abundance of MF zoned land around stations than to the presence of LRT. Zoning land around rail stations for multifamily housing helps to concentrate multifamily housing density, but the effect of LRT alone on multifamily housing development is not strong in and of itself. On the basis of the amount of multifamily-zoned land, the development of multifamily housing is actually occurring at a faster rate near bus stops and arterials than around light rail stops. The large amount of MF zoned land around rail stations is a residual of the station area planning program of the early 1980s. It did not result in rapid development due to the economic recession and political and legal problems with the use of urban renewal and tax increment financing.

Results with Respect to Density

Gross residential density was calculated by dividing the number of dwelling units by the gross acreage of the block group, while net residential density divides the number of dwelling units by the area devoted to residential use in 1980, 1990 and in 1996 as determined by the year-built variable in Portland Metro’s Regional Land Information System (RLIS).

Figure 3 presents the net density values for the two corridors and their inner and outer portions that reflect the central city and suburban portions, for 1980, 1990 and 1996, showing a density decrease in both inner corridors, and a slight increase in both outer corridors. Figure 4 presents change in residential density from 1980 to 1996. Interestingly, it shows that the percent increase in the rail corridor is less than in the bus corridor, which may be another indication that LRT alone is not sufficient to increase residential density.

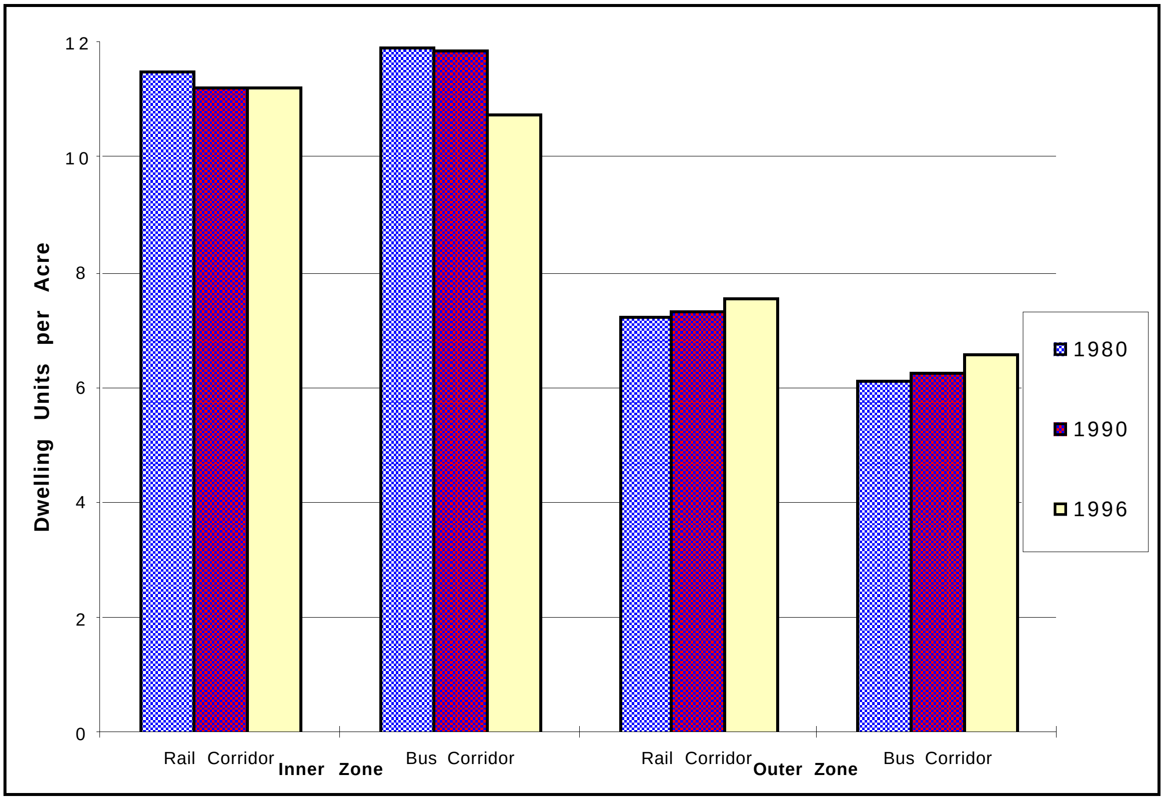


Figure 3: Net Residential Density, 1980-1996.

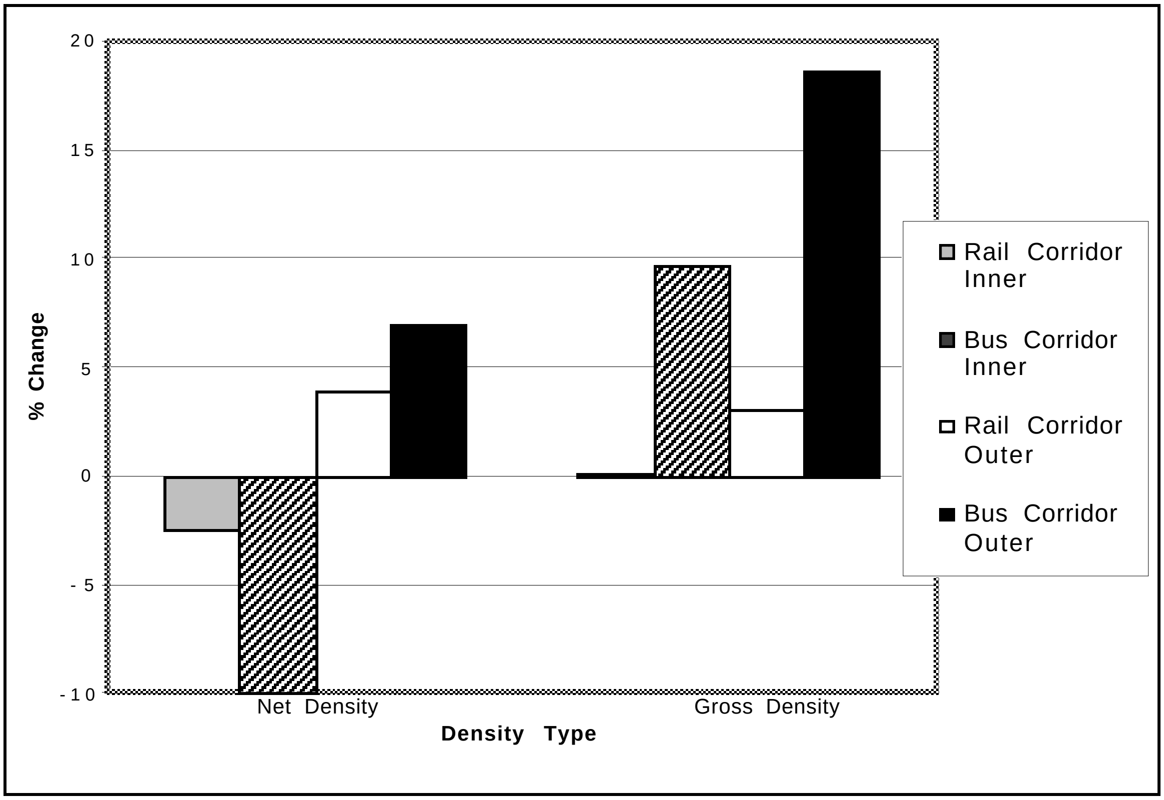


Figure 4: Percent Change in Residential Density, 1980-1996

Results with Respect to Property Values

One measure of benefit of a transportation investment is an increase in property values in areas of impact. Economic theory assumes that access to transportation services should be capitalized into property values. However, living close to an LRT line may also increase noise, traffic, and other nuisances, with a resulting decline in home values. Proximity to LRT may have two different effects on residential property values. On the one hand, accessibility (proximity to the LRT stations) increases property values. On the other hand, nuisance effects (proximity to the LRT line) decreases property values. Chen, Rufolo, and Dueker (1997) examined the impact of light rail on single-family home values in the outer part of the eastside rail corridor, using distance to rail stations as a proxy for accessibility and distance to the line itself as a proxy for nuisance effects. The study results are robust and show that incorporating both the distance to stations and the distance to the rail line allows for separation of the accessibility effect (positive) and the nuisance effect (negative). The accessibility effect dominates the nuisance effect. The results suggest that a positive price gradient does exist with respect to station accessibility.

The real estate market has responded positively to LRT. Figure 5 illustrates that the model estimates that a house that is valued at $82,800 (median price of housing in sample) at an LRT station would be valued at $80,500 a distance of 200 feet away, $78,554 a distance of 400 feet away, $76,961 a distance of 600 feet away, $75,721 a distance of 800 away, and $74,835 (10% reduction) a distance of 1000 feet away from a rail station. This willingness to pay a premium for single-family housing having LRT access is a significant and positive land use benefit of the LRT investment.

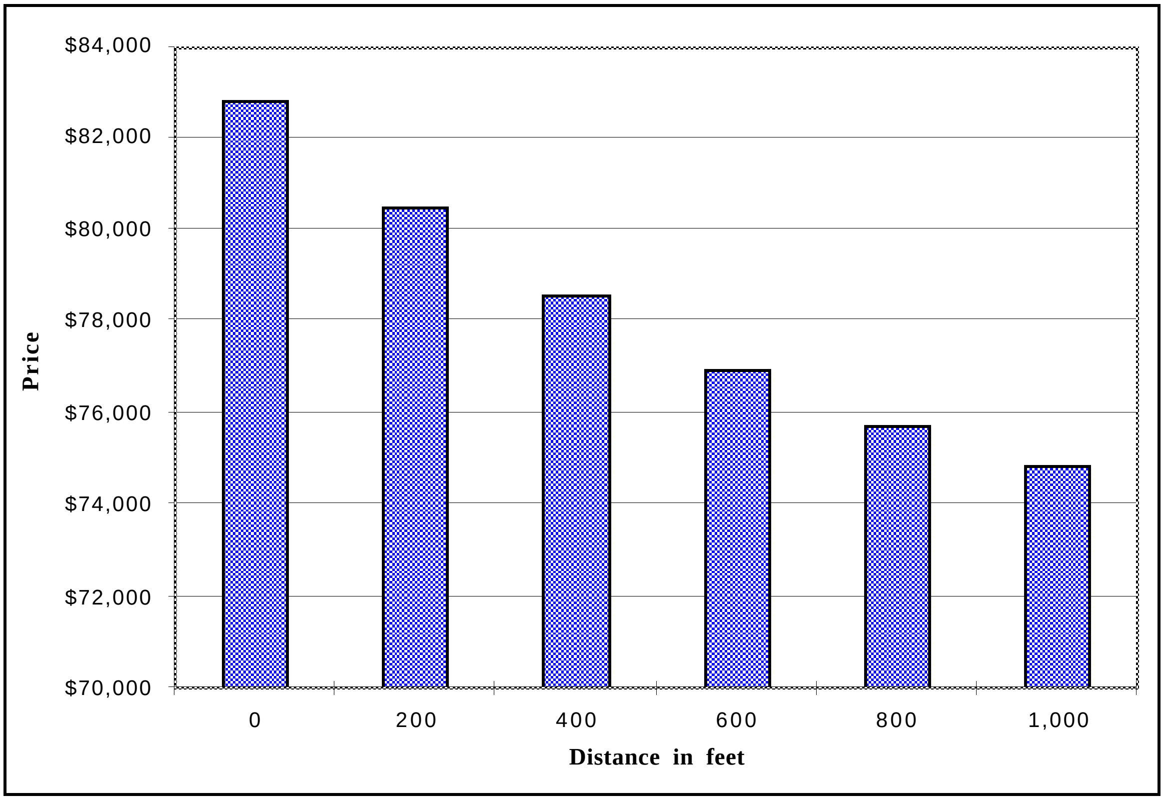


Figure 5: Price Effect of LRT on Single-family Housing

Results with Respect to Vehicle Ownership

There has been a slight effect of LRT on vehicle ownership. It was expected that light rail would lessen dependency on multi-auto ownership. Figure 6 presents the results of comparing 1980 and 1990 vehicle ownership data from the U.S. Census of Population and Housing and the 1996 dress rehearsal American Community Survey for the rail corridor and the parallel bus corridor.

One comparison is for the inner city portion of both corridors. In the rail corridor, the zero and one vehicle ownership rate was 62.3 percent in 1980 and 56.0 percent in 1990, a 6.3-percentage point difference in share, as compared to a rate of 64.4 percent in 1980 and 59.6 percent in 1990, a 4.8-percentage-point difference in share, for the parallel bus corridor. Both inner corridors saw a shift to more two-vehicle households and a loss of zero- and one-vehicle households. Both shifts are detrimental to transit ridership, and LRT is not reversing the trend of increased auto availability in the inner portion of the study area.

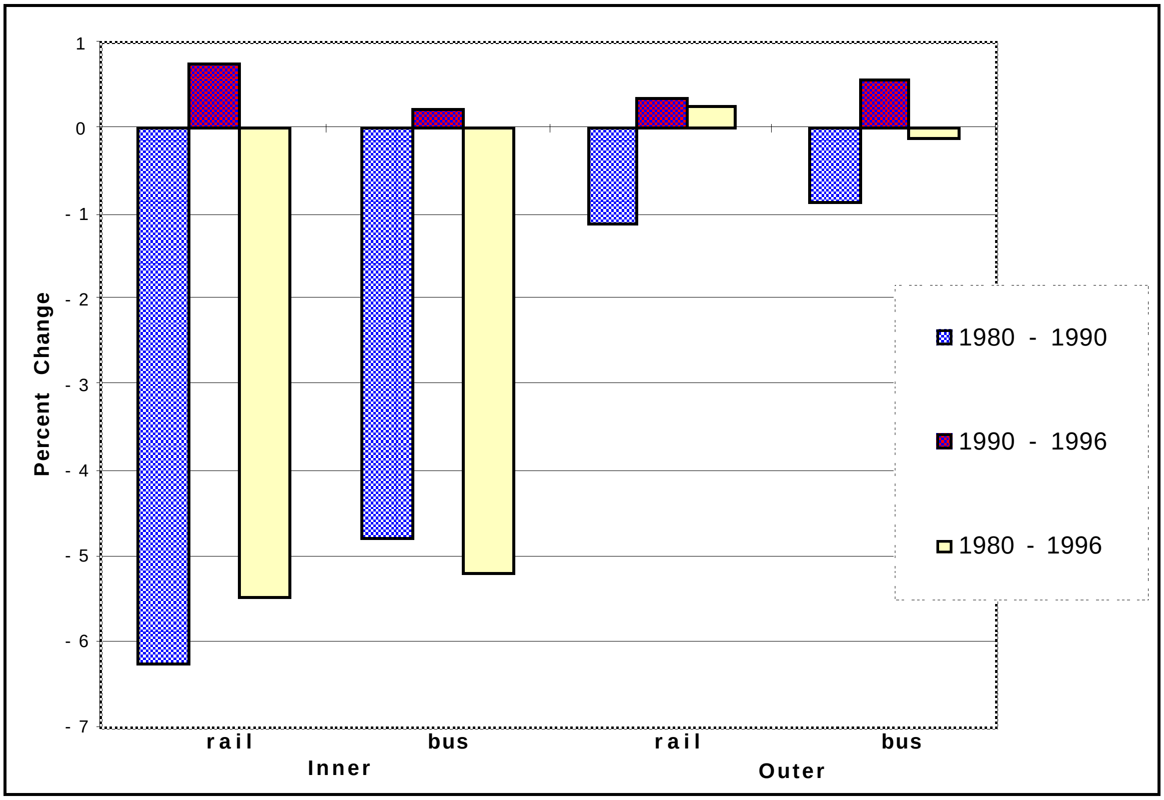


Figure 6: Change in Zero and One Vehicle Ownership, 1980-1990, 1990-1996, 1980-1996.

A second comparison is for the outer portion of the corridors. In the rail corridor the zero and one auto ownership rate was 49.0 percent in 1980 and 47.9 percent in 1990, a 1.1 percentage point decrease in share, as compared to a rate of 45.4 percent in 1980 and 44.5 percent in 1990, a 0.9-percentage point decrease in share for the parallel bus corridor. Change from 1990 to 1996 shows a small increase in zero and one vehicle households, which may represent a difference in methodology or definitions from the decennial census to the new American Community Survey. In any event, there is no significant difference to attribute to light rail. However, in comparing the entire period, 1980-1996, the outer rail corridor shows a slight increase in zero- and one-vehicle households, while the outer bus corridor shows a slight decrease in zero- and one-vehicle households. This is a promising result. Multiple-vehicle ownership has stabilized in the outer corridors, and there is a slight gain in zero- and one-vehicle households (or loss in multiple-vehicle ownership) in the outer rail corridor.

Results with Respect to Transit Share

The effect of LRT on transit share is even more encouraging. Figure 7 presents the results of comparing 1980 and 1990 journey-to-work data from the U.S. Census of Population and Housing and the 1996 dress rehearsal American Community Survey for the rail corridor and the parallel bus corridor.

In the inner city zone, the rail corridor lost transit share from 15 percent in 1980 to 13 percent in 1990, and to 12.6 percent in 1996, while the inner corridor served by bus lost transit share by only a slightly larger amount, from 19.7 percent to 15.6 percent in the 1980 to 1990 period, but rebounded to 18 percent in 1996. In the outer zone, the rail corridor maintained transit share, at 9.5 percent in 1980 and 9.5 percent in 1990, growing to 12.7 percent in 1996. In the bus-only corridor, transit share fell from 9.2 percent to 7.9 percent, from 1980 to 1990 and grew slightly to 8.1 in 1996. These results show that mode shifts take time to develop and seemed to be largely confined to the outer corridor. In the inner zone, ridership response is better in the bus corridor than the rail corridor, probably due to longer walk distances to rail stations in the freeway right of way.

The slightly better transit share in the outer rail corridor may be due to better transit service. Travel times, according to the LRT schedule, from the Portland CBD to Gresham is 46 minutes in the PM peak and 44 minutes in the AM peak direction. The comparable scheduled times in the parallel bus corridor, Route 9, between the Portland CBD to and from Gresham is 58 - 69 minutes in the PM outbound peak period, outbound, and 56-58 minutes in the inbound AM peak period. Off-peak travel times range from 43 to 46 minutes by LRT and 53 to 61 by bus.

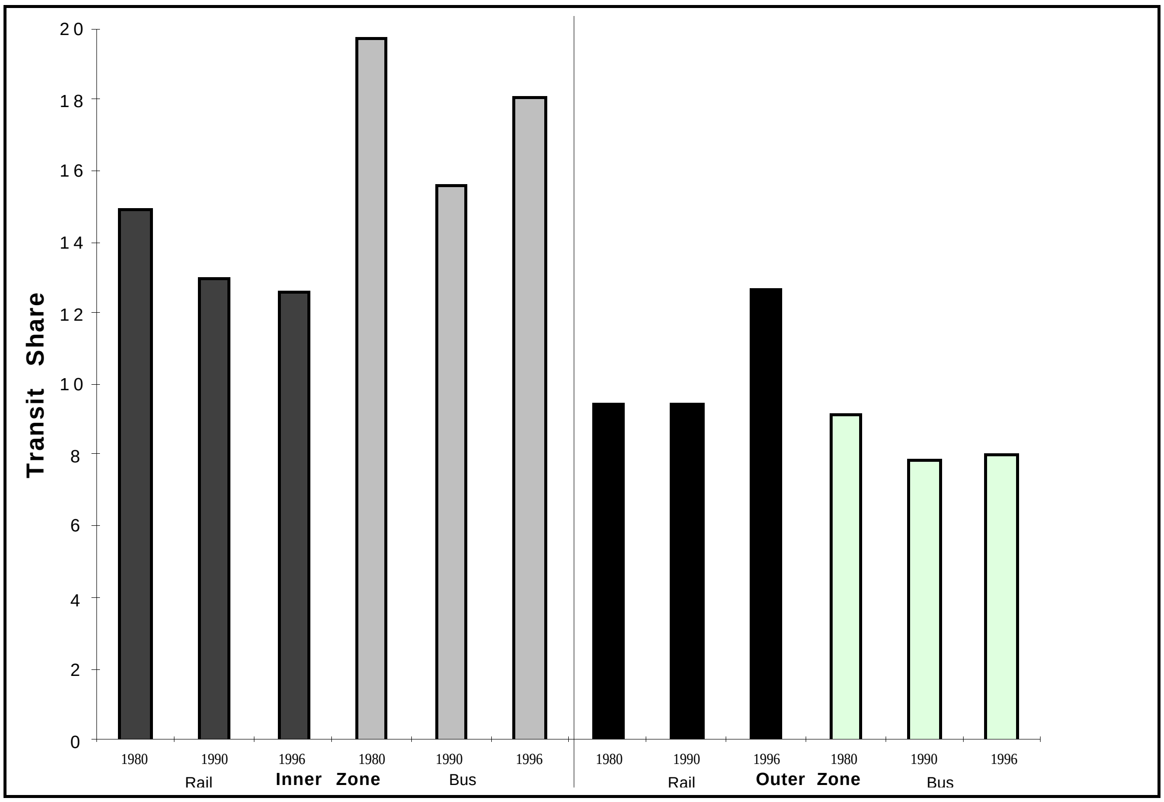


Figure 7: Journey-to-Work Transit Mode Share. In the outer rail corridor transit share remained constant then increased, while it decreased by 14 percent in the outer bus corridor then rebounded some. Both inner zones lost transit share.

Figure 8 presents the percent change from 1980 to 1996 in journey-to-work mode shares for each corridor. The outer bus corridor has lost 1.2 percent in commuting by transit, while the outer rail corridor has had a 3.2 percent increase in commuting by transit. Auto share declined slightly in the outer rail corridor, while it increased in the other corridors. This indicates the outer rail corridor is attracting households more inclined to use transit than is the case in the parallel outer bus corridor; this may also help to explain the bidding up of housing prices near rail stations.

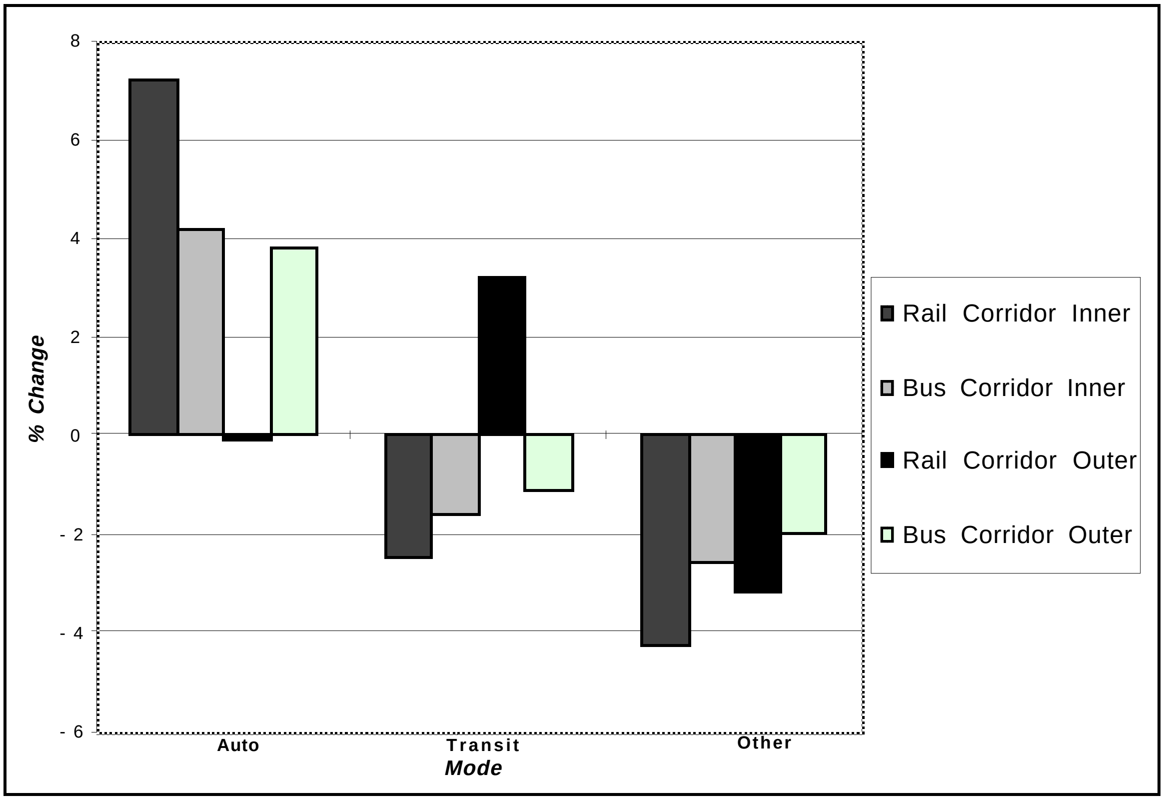


Figure 8: Percent Change in Journey-to-Work Mode Shares, 1980-1996

Transit share erodes, except in the rail corridor. The new light rail service and the feeder bus routes have staved off some of the erosion that has occurred nationally and in Portland as a whole. In fact, it has reversed the trend in the outer rail corridor.

Results with Respect to Journey-to-Work by Destination, 1990

Figure 9 presents the percent of commuters destined to the CBD by corridor from the Census Transportation Planning Package, and Figure 10 presents the share of CBD-destined commuters using transit by corridor. The outer rail corridor was expected to show a larger proportion of CBD-destined commuters than the outer bus corridor, but it did not. Just as the majority of the mode shift occurred after 1990, the residential sorting occurred later.

In a study of residential location choice in the Philadelphia region, Voight (1991) observed a process called "residential sorting," which is self-selection of home location in response to employment accessibility. Voight found that census tracts with commuter rail service averaged 12 percent more of their residents working in downtown Philadelphia than were observed in surrounding tracts. In the Portland study, the share of CBD commuters using transit in 1990 in the rail corridor is slightly higher than in the outer bus corridor, 34.9 percent as compared with 33.3 percent (see Figure 10). Consequently, residential sorting may be occurring but the numbers are barely detectable using the 1990 census data. Year 2000 census data should be able to provide more definitive results to augment the mode shift and auto ownership data analyzed herein. Residential sorting is suspected by indications of differences in vehicle ownership and changes in transit share in the outer parts of the corridors.

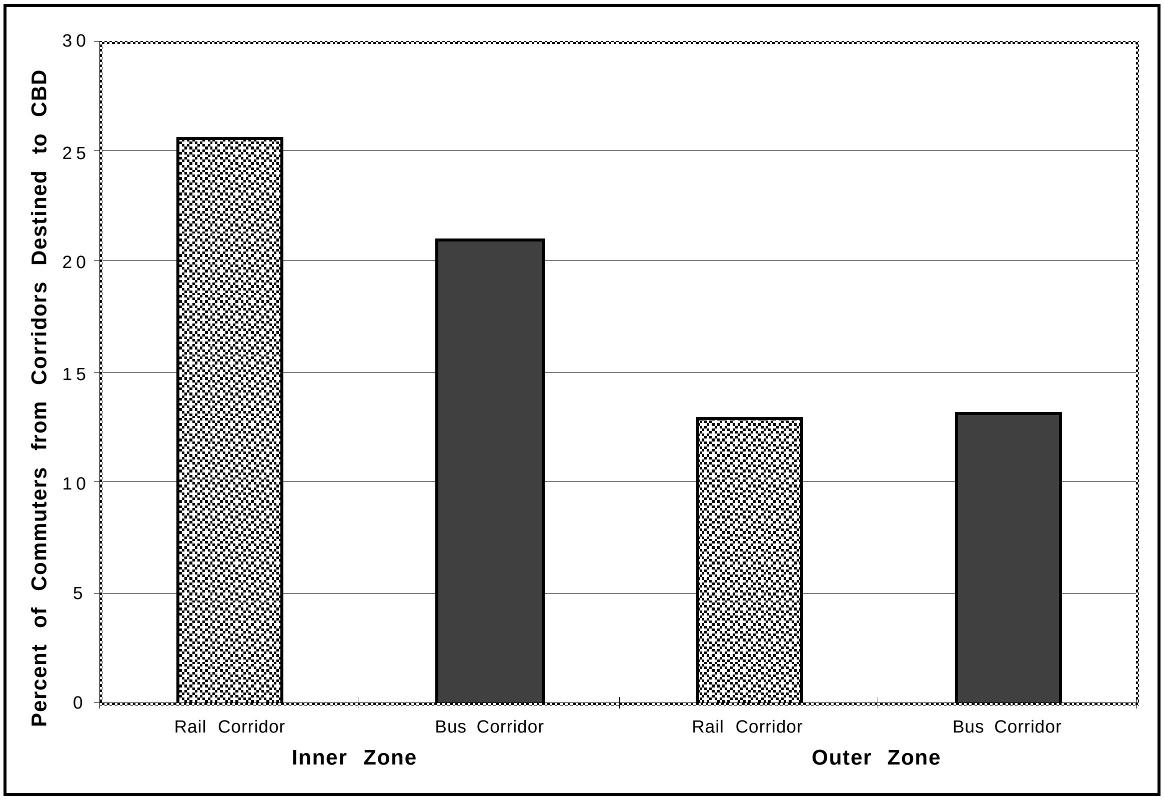


Figure 9: Commuting from Corridors to CBD, 1990

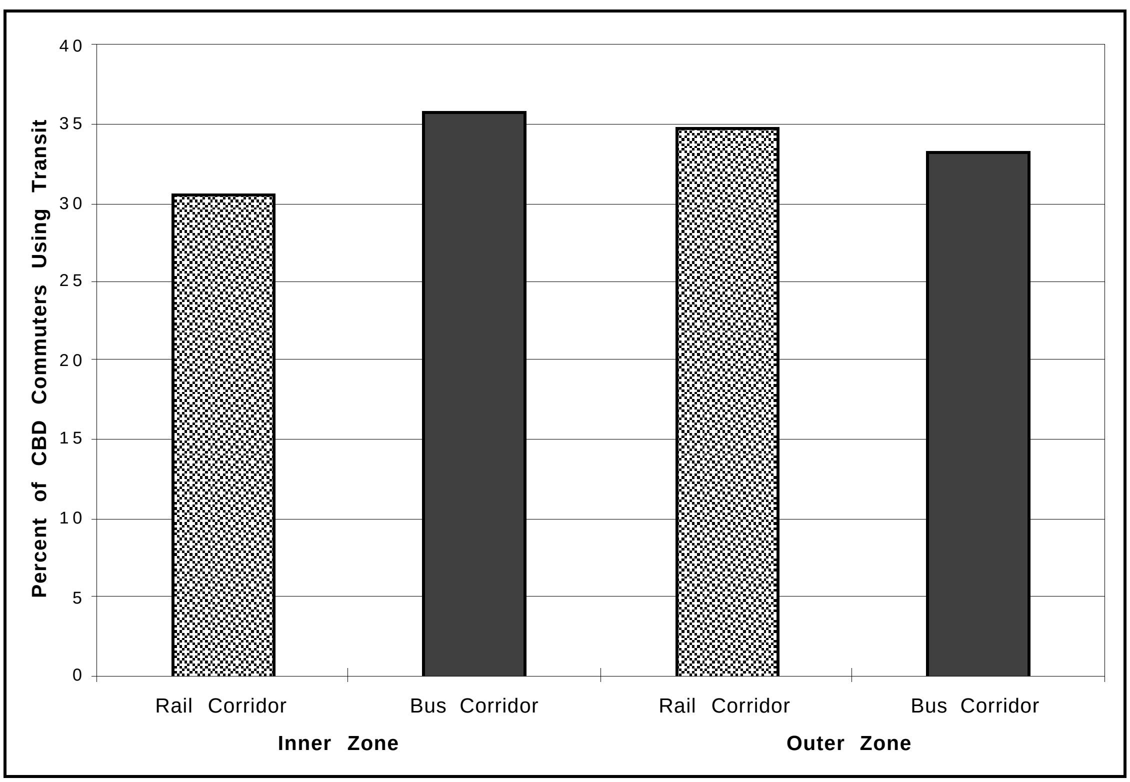


Figure 10: Share of CBD-Destined Commuters from Corridors Using Transit, 1990

Growth of Eastside LRT Ridership

LRT ridership in the rail corridor is usually reported in terms of average weekday boardings or originating rides. Average originating weekday ridership for the eastside LRT has grown from 15,600 in FY87 to 23,400 in FY97, and boardings have grown from 19,500 to 29,400 during the same period. This is a 50-percent increase from 1987 through 1997 fiscal years, or an average annual rate of increase of 4.5 percent. As illustrated in Figure 11, the rate increased from an annual rate of 3.8 percent for the first five years of operation to an average annual rate of increase of 4.8 percent for FY93 through FY97, the last five years.

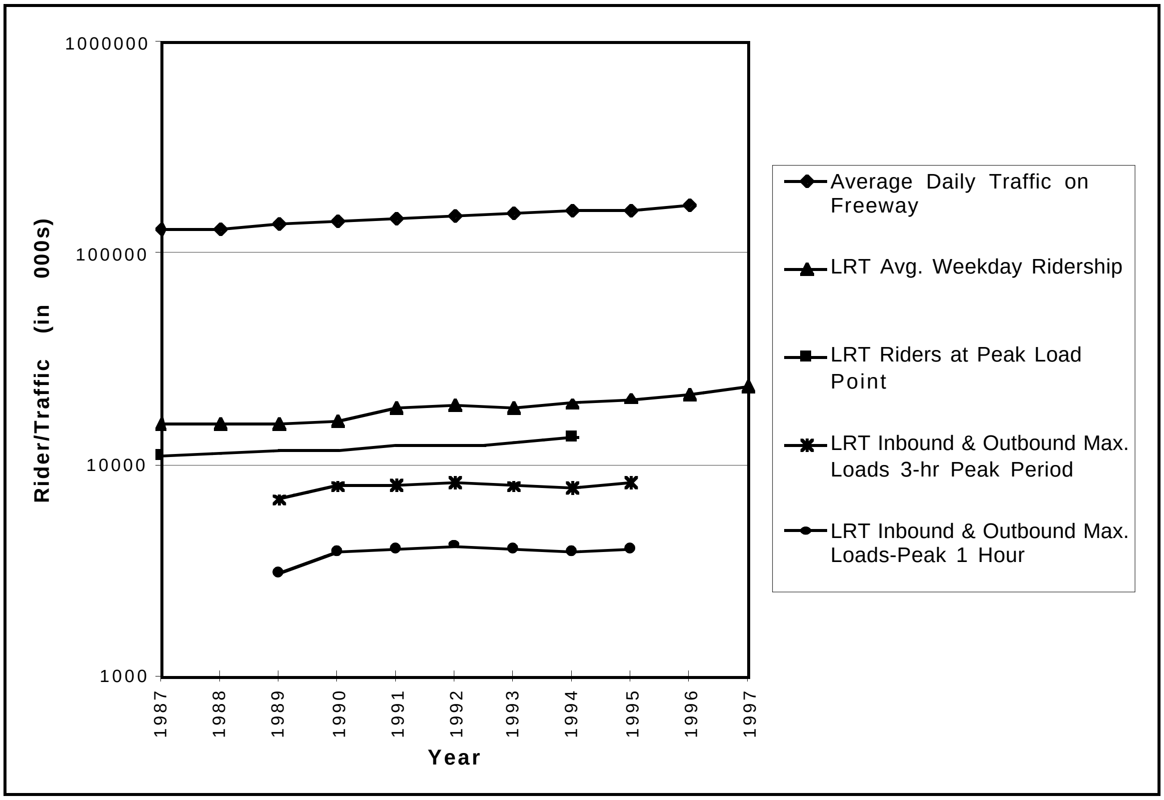


Figure 11: Banfield Corridor: Growth in Riders and Traffic

In comparing transit ridership to highway traffic, it is preferable to use a measure of ridership past a point rather than total ridership. The peak loadpoint is at the Lloyd Center and the all-day maximum total loads are at the Convention Center. Only two data points are available: 11,100 at the Lloyd Center in 1987 and 13,600 at the Convention Center in 1994, a 22.5-percent increase or 3.2-percent average annual rate. This compares favorably with a 23.8-percent increase (3.4-percent annual rate) in highway traffic on the Banfield freeway.

This encouraging assessment of eastside LRT ridership is diminished somewhat by the flatness of peak-hour ridership, despite growth in overall rail ridership. Peak-hour ridership has remained at about 2000 riders per hour for the period of FY 89 through FY95. Similarly, the ridership in the peak three-hour period is also flat, at 4000 riders averaged over inbound and outbound periods. So the shoulders of the peak hour are not growing either. This does not bode well for congestion relief or air quality improvements during the peak period, which was a six-year period when the region grew rapidly. There is a growth in off-peak ridership which contributes to a broader transit ridership base. Although light rail is not contributing significantly to peak-hour congestion relief or air pollution reduction, the non-peak hour ridership growth has exceeded expectations. This broadening of the transit ridership is a small but perhaps promising signal for TOD advocates. However, this growth may well be self-selection in terms of transit-oriented households locating into existing housing in the outer rail corridor, as opposed to conversion of auto travelers to transit.

Interpretation and Discussion of Corridor Comparisons

This paper has compared the rail corridor to a parallel bus corridor using several measures: the amount of multifamily housing development, residential density, housing price, mode choice, vehicle ownership, and commuting to CBD. Three kinds of positive LRT impacts were found. There has been a gain in transit mode share for commuting in the outer rail corridor from 1980 to 1996, while the outer bus corridor has had a slight loss of transit share for commuting. Similarly, there has been a slight gain in zero- and one-vehicle households in the outer rail corridor from 1980 to 1996 as compared with the outer bus corridor. Also, the property value of single-family housing in the outer rail corridor is impacted positively by accessibility to rail stations. These effects may reflect self-selection or residential sorting, wherein households appreciating transit access are locating near LRT in the outer part of the rail corridor. This self-selection in the eastside rail corridor ought to be reinforced with the Gresham Civic Center development, the first real TOD in that corridor, which is under development.

The effects, while positive, remain modest. This may be expected, given the relatively short time between the light rail opening in 1986 and the date of the post-study data, 1996 for some census data and 1995 for the multifamily housing data. Would a year 2000 comparison show a stronger light rail effect? Probably, as transit-related property tax abatements are being given to apartment developments around rail stations that will be occupied before year 2000. Legislation enacted in 1995 enables property tax abatements within one-quarter mile of any light rail station or fixed-route bus route to encourage residential growth near transit. This public policy response underscores the notion that LRT investment alone may be insufficient to encourage densification. Supportive public policy may be required as an adjunct.

The following section attempts to translate the experience of the eastside rail to implications for the westside light rail, where greater reliance on TODs ought to result in even greater self-selection or residential sorting, as well as some conversion of auto users to transit. Although the westside implications are quite speculative, they are developed to provide a context for assessing rail impacts in a new corridor.

Implications for Westside LRT

Even the supporters of LRT in Portland concede that the land use impacts, in terms of residential density, have been disappointing or at best slow and difficult and that TODs have not occurred naturally -- that is, without greater public policy intervention. As a result there is considerably more attention to nurturing TODs on the westside LRT line, necessarily so because the route traverses an area where existing transit ridership is low and through an area containing large tracts of undeveloped land, creating both an opportunity and necessity for TODs. Consequently, the westside LRT line to Portland's westside suburbs of Beaverton and Hillsboro will be a more important test of TODs than the eastside line to Gresham.

TOD development is being actively promoted, both by the regional transit agency, Tri-Met, and local jurisdictions in the westside LRT corridor. This encouragement and planning and zoning expediting, along with a strong market for multiple-family housing, is resulting in a number of new developments in the corridor, advertised as transit oriented.

Yet, even with the attention to and opportunity for TODs on the west side, the actual impacts may be limited. The expectation is that TODs will increase land development densities, reduce vehicular trip generation, increase transit mode share, and reduce trip lengths, all of which will reduce vehicle miles of travel (VMT) per capita. At the same time, though, the additional density will increase auto trips per unit area.

Conclusions

Based on the empirical analysis, three positive impacts of eastside LRT were observed. One is that households in the outer portion of the rail corridor are less auto oriented in comparison to the control group, the parallel bus corridor. The second is that households in the outer part of the rail corridor are also more likely to use transit in comparison to residents in the outer bus corridor. The third is a bidding up of single-family housing prices near rail stations in the outer part of the rail corridor. It is unclear whether these effects are due to conversion of auto users to transit riders or stemming from the attrition of existing riders. Alternatively, LRT impacts may be linked to self-selection or residential sorting of households. The outer rail corridor may simply be attracting residents who are more prone to use transit in the first place. This issue needs further research.

The empirical analysis of multifamily housing development and density change in the eastern suburban area of the Portland region served by LRT and conventional bus transit provides evidence that light rail alone has not been sufficient to change development patterns appreciably. Recognizing that zoning high density around station areas may not be enough to increase the impact of light rail, the Portland community of planners has embraced the TOD approach, in an effort to “make light rail work.” New Urbanism concepts regarding higher densities and mixed-use development will be tested more extensively in the new westside LRT corridor where TOD planning has been emphasized. The extent to which these planning efforts can reverse historic decentralization and future trends augured by changing improvements in transportation and communications technologies remains to be seen.

The risk that TOD planners take in emphasizing the costly light rail component of transit-oriented design is that they may shortchange other, more pressing needs. A plan that puts expensive light rail before expanded bus service, as well as highways and other mobility improvements, risks ignoring the majority who do not live near light rail transit or who, because of family and lifestyle needs, require an automobile. By the same token, an emphasis on multifamily housing may result in decreasing and unaffordable options for households who, because of family and lifestyle characteristics, desire or require single-family housing (Different Drummer 1996, 60-61). Finally, most TOD planning efforts target areas of new growth, thereby continuing to neglect the serious and complex problems of the inner city, where the most transit-using and transit-dependent people reside. The emphasis becomes misplaced, chasing the elusive choice rider while underserving the captive rider.

The challenge to planners is to assess development trends and consumer behavior. This assessment will provide the basis for estimating market shares for dispersed and concentrated development forms. There is undoubtedly a market for higher densities and mixed-use development. No doubt, there is a segment of the population that prefers multifamily living and traveling by transit. The challenge is to identify this segment and to enhance their options without ignoring the needs of other segments of the population. At the same time, planners are challenged to respond to concerns about the environment and inequitable housing through a multifaceted approach, which includes TODs, but also includes more direct measures and reforms, including pricing.

This assessment of LRT impacts in Portland is both encouraging and sobering. It identifies some emerging trends in residential location, but the overwhelming trend toward auto use and decentralization serves to caution against overly optimistic assessments of large impacts, in the foreseeable future.

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References

Audirac, A. & Shermyen, A. H. (1994). An evaluation of neotraditional design's social prescription: Postmodern placebo or remedy for suburban malaise? Journal of Planning Education and Research, 13 (2), 161-173.

Bernick, M. & Cervero, R. (1997). Transit villages in the 21st century. McGraw-Hill.

Cervero, R. & Gorham, R. (1995). Commuting in Transit Versus Automobile Neighborhoods. JAPA 61, (2), 210-225.

Chen, H, A. Rufolo, & K. Dueker. (1997) Measuring the Impact of Light Rail Systems on Single Family Home Values: A Hedonic Approach with GIS Application. Center for Urban Studies, Portland State University, DP 97-3. Transportation Research Record. (forthcoming)

Crane, R. (1998) Travel by Design, Access 12 (Spring 1998), 2-7

Different Drummer: Taking a fresh look at national resource issues. Volume 3, No. 2: "The vanishing automobile and other urban myths" (Spring 1996).

Dueker, K. & Bianco, M. (1998). Effects of Light Rail Transit in Portland: Implications for Transit-Oriented Development Design Concepts. Center for Urban Studies, Portland State University.

Frank, L. & Pivo, G. (1994). Impacts of Mixed-Use and Density on Utilization of Three Modes of Travel: Single-Occupant Vehicle, Transit, and Walking. Transportation Research Record 1466, 44-52.

Friedman, B., Gordon, P., & Peers, J. Effect of Neotraditional Neighborhood Design on Travel Characteristics. Transportation Research Record 1466, 63-70.

Giuliano, G. (1995). The weakening transportation-land use connection, Access, 6, 3-11.

Pisarski, A. (1992). New perspectives in commuting, Federal Highway Administration, U.S. Department of Transportation.

Spector, P. (1981). Research Designs. Sage University Paper Series on Quantitative Applications in the Social Sciences, series no. 07-023. Beverley Hills and London: Sage Publications.

Voight, R. (1991) Transportation, sorting, and house value. American Real Estate and Urban Economics Association Journal, 19 (2), 117-137.