CHAPTER

# 2

# Setting the Framework for Station Area Planning and Transit-Oriented Development

Planning for station areas in Seattle must take into account fundamental principles of land use-transportation linkages that have been proven time and time again through empirical research over the past 20 to 30 years. Land use factors, including jobs-housing balance, residential density, mixed-use, parking and urban design, influence the number, distance, duration, and mode of trips. In particular, these land use factors have a strong influence over whether people will decide to use transit rather than other available means of transportation, particularly the private automobile.

Not only does land use influence trip-making, but transit investments influence land development and create opportunities for transit-oriented development. While rail cannot create new growth, land use policies can help direct development to station areas. By understanding these factors, the City can plan for station areas, such that the resulting land uses, densities, and urban design will support transit use.

## RELATIONSHIPS BETWEEN LAND USE AND TRANSIT

Planning for transit-oriented development requires an understanding of key relationships between land use and transportation. These relationships will be described in this section and include:

- *Conceptual Framework*. Key relationships between land use and transportation as conceived in urban economics.
- *Influence Of Land Use On Trip-Making Characteristics*. Key land use factors that affect the number, duration and distance of trips.
- *Trip-Making Decisions and Mode Choice*. Key factors that influence decisions about travel mode. Land use is only one of these factors, suggesting that land use alone cannot single-handedly create a market for transit use.

Based on these key relationships, it is possible to determine the critical factors that are necessary for transit-oriented development.

## CONCEPTUAL FRAMEWORK

The conceptual framework is simple. Theoretical and empirical research has shown that land use and transportation are linked such that transportation investments shape long-term development patterns, and development patterns influence the use and operation of transportation systems.[1] Where transportation improvements provide faster, more convenient, or less costly service, land development may shift locations in order to take advantage of improved access in specific places. The fundamental relationship between land use and transportation is as follows:

- *Where transportation investments improve access, they create pressure for more development.* One of the fundamental insights of urban economics is that if two properties are identical in every respect but the time, effort, or cost it takes to travel to each property, then the property with better accessibility will command a higher market price. As land becomes more expensive, developers will use relatively less land to provide housing and employment, building upward rather than outward, given the right regulatory environment. Accessibility improvements affect real estate markets not only adjacent to transportation facilities but also within a larger commute shed.[2]
- *The type, amount, mix, and intensity of land use influences transportation systems and their operations, and more intensive development requires coordinated land use strategies*. Land uses and development that generate larger travel demands (i.e., higher-intensity development) can be located in proximity to major transportation facilities, making efficient use of the facilities and ideally improving system performance (more balanced flows, fewer congestion "hot spots"). Land use patterns that are not designed to optimize the capacity of the existing transportation facilities may later demand additional transportation investments in order to improve access.[3]

Based on these fundamental concepts, urban economists and geographers have developed empirical and theoretical models of residential location, employment location, and commute patterns. All of these posit a tradeoff between housing costs and journey to work costs. Where a transportation improvement lowers transportation costs, it encourages more land development and housing further from major employment centers. If the transportation improvement affects only one corridor, then residential land prices and density will increase in that corridor relative to other corridors. Employment location theory suggests similar conse-

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[1] The Bibliography summarizes relevant research and case studies. Most relevant is the Transit Cooperative Research Program's *Transit, Urban Form, and the Built Environment: A Summary of Knowledge* prepared by Parsons Brinkerhoff Quade & Douglas for the Transportation Research Board. ( Washington: National Academy Press, 1996).

[2] In the BART Impact Program, for example, statistical analysis of historic changes in property prices and rents around transit stations and in corridors served by BART showed small but statistically significant changes both in anticipation of service and during years after opening. Area-wide effects also were documented. See Michael Dyett, *et al, Land Use and Urban Development Impacts of BART* (Oakland: Metropolitan Transportation Commission, 1978).

[3] Terry Moore and Paul Throsnes, *The Transportation/Land Use Connection* (Washington: American Planning Association Advisory Service, 1994) pp. 2-4.

quences: reducing transportation costs for a specific employment center will increase production or employment at that center.

When planning to accommodate future travel needs, it is logical to start by looking at what the land development forecasts are and how have these evolved. A regional perspective also can put Seattle's expectations in context, which is important as the City competes for development with other communities who will be served by Sound Transit.

## THE INFLUENCE OF LAND USE ON TRIP-MAKING CHARACTERISTICS

Land use variables play a key role in influencing the number, distance, duration, and mode of trips, even though the degree of the relationship between land use patterns and trip characteristics is sometimes difficult to quantify. Some key land use variables include jobs-housing balance, residential density, employment density, mixed-use development, location of development relative to transportation systems, availability of parking, and urban design. All of these will need to be considered in the station area planning program.

### *Residential Density*

One of the most important variables influencing transit use is residential density. A resident is 30 percent more likely to use transit if he or she lives in a mid-rise or high-rise multifamily neighborhood rather than a single-family neighborhood.[4] In Chicago, for example, doubling residential density doubles transit use. However, for conveniently located housing within a 1/4 mile transit stop, density matters less than the characteristics of the destination (the workplace). Specifically, downtowns with 20 million square feet for more can sustain rail transit service.

### *Employment Density*

Average employment density at trip origins and destinations is highly correlated with mode choice for buses, walking and single-occupant vehicle (SOV) use. However, carpool preferences are least sensitive to urban form factors. Employment density thresholds for metropolitan centers need to be at least 75 employees per acre.[5] This translates to floor area ratio (FAR) of 0.5 assuming 300 square feet per employee, or 0.7 assuming 400 square feet per employee.

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[4] Transportation Research Board, *TCRP Report 16: Transit and Urban Form* Part 2 (1996) p. 4.

[5] Pushkarev, B.S. and J. M. Zupan, "Where Transit Works: Urban Densities for Public Transportation" in *Urban Transportation: Perspectives and Prospects* (1982) p. 343.

### *Mixed Use Development*

Mixed-use development helps reduce the total number of generated automobile trips. The Institute of Transportation Engineers (ITE) Trip Generation Manual shows that a 100,000 square-foot office building without mixed uses will generate 18.7 more daily trips than an office building with a mix of commercial and service uses. In Los Angeles, for example, commuters to the Warner Center Office mixed-use complex can run daily errands on-site, rather than driving off-site.

In addition to reducing overall auto trips, land use mix, like jobs-housing balance, shortens average trip length and encourages walking and transit use. People who live in mixed-use blocks are more likely to commute by transit, walking or bicycling, and are less likely to commute by car. However, land-use mix is less influential than density, which accounts for 10 to 20 times more transit ridership than land use mix.[6]

### *Location Relative to Transportation Systems*

The location of land uses relative to transportation systems also influence mode choice and trip length. High-intensity commercial uses located in proximity to a highway interchange will allow easy access by automobiles and will therefore encourage automobile travel. Similarly, high-intensity uses in proximity to a transit station will encourage greater transit use.

Not all uses located near a transit station generate the same amount of transit ridership. In Chicago, for example, a 10 percent increase in the share of station-area land devoted to multi-family housing produces a 20 percent increase in transit ridership, while a 10 percent increase station-area land devoted to office or institutional uses produces a 30 to 33 percent increase in transit use.[7] This example is not to suggest that office uses will produce greater ridership than housing at all rail stations in all cities, but it simply illustrates the point that different land uses generate different ridership levels.

### *Availability of Parking*

The amount of parking at a destination influences whether people will choose to use their automobile. If parking is convenient or readily available, the automobile may be the best means of access. If not, people may choose to change the time of their trip, eliminate the trip, or if possible, substitute a similar, alternative destination. People may also choose to carpool, walk, bike, or take transit.

### *Urban Design*

Urban design deals with site-specific issues of building placement and orientation, building massing and scale, and pedestrian movement and comfort, all of which influence the propensity to make local walking and biking trips. Urban design principles cannot create walking

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[6] Transportation Research Board, *op.cit. 4.*

[7] *ibid.* p. 7.

and bicycle trips alone, but in combination with mixed uses and appropriate densities, strong urban design can support and further encourage additional walking and biking trips. In an adequately dense environment around a transit station, mixed land uses and strong urban design characteristics can reduce automobile trips by 7 percent.

### *Jobs-housing Balance*

The length and duration of the journey-to-work can be minimized, if commuters can find affordable, attractive housing in close proximity to their jobs; or if they can find an appropriate job near their place of residence. A jobs-housing balance may not be necessary within every local community or jurisdiction, but a balance along a commute corridor can help minimize the journey-to-work. While simplistic, policies for a jobs-housing balance can help expand opportunities for housing and employment and can potentially alleviate traffic congestion and achieve air quality goals. There is evidence that at the regional scale, a jobs-housing balance can help reduce total trips.

Criticism of the jobs-housing balance concept stems primarily from the fact that the relationship between workplace location decisions and residence is very complex; people may not always select their job and place of residence in order to minimize their commute. Other concerns are that jobs-housing balance does not reflect incremental trip costs (these are small relative to housing costs). Also, it does not account for multiple worker households or gender differences between household members, which affect decisions on journey-to-work.

## TRIP-MAKING DECISIONS AND MODE CHOICE

Trip-making decisions, including the choice of mode, are based on many factors. In the most rational scenario, mode choice is based upon the relative time, cost, and availability of alternative transportation modes. However, mode choice is not simply the result of a rational decision between equally weighed travel tradeoffs. Based on theory and empirical research, perceived cost, household characteristics, and land use also affect mode choice. These additional factors shape the context in which people make trip decisions.

### *Transportation Time and Cost*

Persistent, daily traffic congestion and delay may reduce the likelihood that a person will choose to drive to work. For example, although an urban rail transit trip in many metropolitan areas typically takes more time than a car trip without traffic, the presence of traffic can increase the travel time so much as to make transit a relatively more appealing option. During peak hours, when regional highways are congested in key spots, such as Interstate 5, Sound Transit may offer time savings, despite the additional time required for reaching the station, waiting for trains, and transferring.

Similarly, the cost of transportation affects the mode choice that people will tend to make. Carpooling is faster than driving alone, because HOVs are allowed to by-pass other traffic, and it is less expensive than transit. Carpool members also can share the cost of bridge tolls.

### *Transportation Availability and Convenience*

The availability and relative convenience of competing transportation modes strongly influences trip-making decisions.

- *Availability and Cost of Parking*. The availability and cost of parking is a key factor in determining whether people will drive to their destination. If reasonably-priced parking is not readily available, as in Seattle's Downtown, some people will be discouraged from driving and may opt to take alternative modes of travel. Increasing the cost of long-term downtown parking through parking taxes can influence mode choice. Similar pricing policies in Seattle's other employment centers also may influence mode choice.
- *Availability of Alternative Modes*. Clearly, if a household has an available car, and alternative modes of travel are unavailable or difficult to access, then people will be more likely to use their car.
- *Convenience and Flexibility*. Many people prefer to use a private automobile in order to have the flexibility to perform a variety of tasks during the course of a day. For example, many people claim to need their car at work, because they need to pick up their children after work, because they need to run necessary errands, etc.

### *Perceived Cost*

People make travel decisions partly based upon the perceived relative cost of competing modes of travel. Although automobiles may be relatively more expensive than riding transit (considering the cost of the car, insurance, maintenance, gas, parking, and tolls), most costs are paid up-front in separate bills, and the cumulative cost is therefore "hidden." By comparison, transit requires a frequent, typically daily, out-of-wallet payment, making the cost seem greater. People may opt for using automobiles simply to avoid this higher perceived cost.

### *Household Characteristics*

The characteristics of households also influence the transportation mode that people choose.

- *Number of Cars per Household*. Generally, if a car is available, the members of a household will opt to use it, rather than using some alternative mode of transportation. The greater number of cars, the greater number of automobile trips are made. Moreover, not only do households with more cars make more auto trips, they tend to make more trips altogether.
- *Dual-Income Households*. In households where both members of the couple work, there are differences in mode choice between the members of the household. There is some evidence that in households with only one car, men tend to use the automobile for commuting, and women tend to use transit or other modes. When women do have access to a car, there is evidence that they are more car-dependent and make more trips, because they need to make trips for childcare and eldercare in addition to work trips.

### *Land Use Patterns*

The intensity and mix of land uses, in addition to the urban design of public spaces, strongly influences whether people will choose to drive alone or whether they will opt for a more efficient form of travel, such as carpooling or transit.

#### *Residential and Employment Density*

Many researchers have studied the relationship between density and mode choice. They have found that as residential and employment density increase, the use of single-occupancy vehicles decreases, and the use of transit and other alternative modes tends to increase.

- *Residential Density*. Specific thresholds of residential density can support increasing types of transit use. A minimum of 7 dwelling units per net acre is generally considered necessary to support minimum regular transit service, i.e. buses circulating with 1/2-mile route spacing and in 30 minute intervals. As residential density rises to 30 dwelling units per net acre, transit usage has been found to triple.[8] Similarly, in Chicago, a doubling of residential density has been found to double transit use.[9]
- *Employment Density*. While higher residential densities result in greater transit use, higher employment densities can help reduce the use of single-occupancy vehicles (SOV) and encourage alternative modes, including transit. In the Puget Sound region, for example, a doubling of existing employment densities from 10 to 20 employees per acre was found to reduce SOV use by 2.8 percent and to increase bus trips by 1 percent. Increasing employment densities tenfold, to 100 employees per acre, was found to reduce SOV use by 25 percent and to increase bus use to 11 percent of the mode split.[10] Walking and carpooling were encouraged by increased employment densities.

#### *Size of Job Centers*

Closely related to residential and employment density, the size of the job center also bears a strong influence on the mode choice for work trips. A minimum of 5 million square feet of commercial space is thought necessary to sustain very low levels of bus service, and 20 million square feet is generally necessary to support light rail service. Rapid transit can serve job centers that range from 50 million to 500 million square feet in commercial space.

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[8] Boris S. Pushkarev and Jeffrey M. Zupan. "Where Transit Works: Densities for Public Transportation," *Urban Transportation: Perspectives and Prospects* (1982), 341-44. U.S. Department of Transportation. *Encouraging Transportation Through Effective Land Use Actions* (May 1987), 31.

[9] Transportation Research Board. *TCRP Report 16: Transit and Urban Form*, Part 3,(1996), 4.

[10] Washington State Department of Transportation. *An Analysis of Relationships Between Urban Form and Travel Behavior* (July 1994), 97.

*Land Use Mix*

Mixing residential and commercial uses may help shorten trips and encourage walking, although it is less influential than density in encouraging the use of alternative modes. Density accounts for 10 to 20 times more transit use for commuting trips that land use mix.

In a comprehensive study of 11 cities throughout the United States, the Transportation Research Board found that people who live in mixed-use blocks with non-residential uses within 300 feet of their residences are 1 to 2 percent more likely to commute by transit, 10 to 15 percent more likely to commute by walking or bicycling, and 3 to 4 percent less likely to commute by car.[11]

*Urban Design*

Pedestrian-friendly urban design supports transit use and travel by non-motorized modes. Research conducted at several hundred California work sites indicates that land use mix and urban design features at work sites increase the number of work-related transit trips by 3 to 4 percent. When compared to land use mix, however, urban design was shown to have the stronger impact on the use of alternative modes. Key urban design features included that presence or absence of trees, sidewalks, and graffiti.[12]

## FACTORS CONTRIBUTING TO THE SUCCESS OF TOD

Based on the review of key relationships between land use and transportation, transit-oriented development around light rail stations depends upon specific supporting land use factors:

- *Residential Density*. Densities in the range of 12 to 15 units per acre along a transit corridor are considered the minimum necessary to support light rail.
- *Job Center*. Downtown areas in the range of 20 million square feet of commercial space or more are necessary to support light rail. Downtown Seattle already has more than this amount of commercial space.
- *Mixed Use*. Mixed uses increase the likelihood of transit use, because it encourages local walking and biking.
- *Urban Design*. Building orientation to the street, pedestrian amenities, and the visual quality of buildings and streetscapes can help create a sense of place and support pedestrian activity.
- *Parking*. Reduced parking availability can support transit use and discourage driving to and from the station area.

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[11] Transportation Research Board. *TCRP Report 16: Transit and Urban Form*, Part 3,(1996), 5.

[12] Transportation Research Board. *TCRP Report 16: Transit and Urban Form*, Part 3,(1996), 6-8.

## IMPACTS OF RAIL TRANSIT ON LAND USE

In addition to the influences of land use on transit, there are commonly accepted concepts about the impact of rail transit investments on station area development patterns. Several key lessons emerged that should be considered in station area planning:

- Rail transit by itself is not sufficient to stimulate transit-oriented development;
- Rail transit tends to have the greatest effect in station areas that are non-residential and experience significant improvements in accessibility;
- Rail investments can accelerate development in station areas; and
- Transit-oriented development requires a mix of public policies.

The following sections address each of these conclusions and the research that supports them.

### *Rail transit by itself is not sufficient to stimulate transit-oriented development*

Rail transit alone is not sufficient to change development levels significantly because so many other factors influence the real estate environment and development decisions. These factors include:

- Long-term growth of the regional economy and the corresponding increase in demand for housing and commercial space;
- Regional and local land use policies;
- Auto accessibility;
- Availability of developable land; and
- Amenities and disamenities of a particular site.

While the introduction of rail transit can create opportunities for attracting new development and reinvigorating stagnant areas, the mere presence of rail transit has been unable to revive flat or declining local real estate markets.

Nevertheless, while rail transit by itself does not create transit-oriented development, many studies have observed that rail transit elevates property values in the vicinity of rail transit stations. One would expect households and business to pay more to locate next a rail transit system that provides improved access to other locations within the urban area, as long as the disamenities associated with the transit system (e.g. noise, perception of increased crime, etc.) do not outweigh its benefits.

In a report for the Transit Cooperative Research Program, Cambridge Systematics (1998) reviewed 30 cases that sought to measure the rent premiums or capitalization of time savings in property values near rail transit stations around North America. The amount of the premium depended on the particular rail system, the analytic technique, and the land uses next to the station. Some of the studies found no effect on property values at all, but most found rent premiums in the range of 1 to 5 percent close to the station which decreased to 0% as one moved more than one-quarter mile from the rail station. The potential range in the size

of the rent premium reflects the unique circumstances of each rail system and station area. Higher land values close to station areas do not necessarily mean that land is developed more intensely than it would have been without rail transit. For example, if rail transit is introduced to a fully developed area, the development levels might not change substantially but the accessibility benefits of rail transit would raise neighboring property values. While the literature reveals substantial quantitative evidence of higher property values close to station areas, there is little quantified evidence on the differential effects of rail and supportive policies on the intensity of development around station areas.

### *Rail transit tends to have the greatest effect in station areas that are non-residential and experience significant improvements in accessibility*

Detailed case studies from San Francisco and Washington, D.C. indicate that the largest and most significant impacts are in station areas that had substantial increases in their overall accessibility.[13] Effects were most pronounced at those stations that serve as hubs from extensive radial bus systems that converge on a rail transit station. The zone of these impacts tends to be quite close to the station area, typically within one-quarter mile. Development effects tended to be considerably less for transit stations located in residential neighborhoods, especially neighborhoods of predominantly single-family housing. Residents in these areas frequently oppose zoning changes that would change the character of their neighborhoods.

### *Rail investments can accelerate development in station areas*

Several case studies indicated that the introduction of rail service can hasten investment decisions that would have eventually occurred anyway. In Atlanta, Chicago, Miami, and Washington, D.C., developers indicated in interviews that the location of a transit station caused them to move development plans forward. The transit station focused public attention on an area and provided amenities that caused developers to accelerate some of their plans (Parsons Brinckerhoff, 1997).

### *Transit-oriented development requires a mix of public policies*

If rail transit by itself is not sufficient to stimulate development, it follows that transit-oriented development requires a mix of supportive public policies. The recent guides to encouraging transit-oriented development (e.g. Bernick and Cervero, 1997) identify similar lists of complementary policies that will encourage more densely developed, mixed-use, pedestrian-oriented centers.[14] These policies include:

- A market-based site and phasing plan
- Land assembly
- Infrastructure investment

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[13] See reports listed in the Bibliography.

[14] See also Puget Sound Regional Council, *Creating Transit Station Communities: A Transit-Oriented Development Workbook* (1998).

- Parking management
- Expedited permits and reviews
- Write-down of land costs
- Direct financial participation by government

All of these policies should be considered, and tailored to individual station areas, in the next phase of planning for transit-oriented development. Case Studies of successes and failures in other cities, presented in the next chapter, can help inform Seattle's station area planning.