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Best Practices
Transit

How can Seattle get the most from local & regional transit investments?

Light rail, urban streetcars, commuter rail, BRT, express bus, local bus, vanpool, paratransit, community circulators all either have, or will have, application in Seattle's Center City. How can Seattle maximize transit travel on all modes and increase transit market share for downtown trips? Convenience, reliability, time competitiveness, accessibility, cost, comfort, safety are just a few of the intangible factors beyond simply providing the vehicles and operating the service that will ultimately determine how effective transit can be. This section explores "best practices" that can help Seattle get the most out of transit system investments.

Application of these principles vary depending on the unique characteristics of each city. For example, in some cities comfort and safety may need to be emphasized over other factors as a way to increase the market share for transit. Seattle is unique in how these "best practices" are applied to achieve the objective of substantial increases in the market share for transit, particularly for destinations in Center City and for origin and destination pairs that must traverse Center City. The degree to which these techniques need to be applied can be deduced from a sophisticated analysis of the travel market and the specific needs and desires of each element in the travel market. However, even before such a "market segmentation" study is completed, there are obvious applications of certain elements of transit "best practices" to "Get Seattle Moving."

Three elements in particular are necessary to bring Seattle's transit resources to a point that substantially increased transit mode share can reasonably be expected.

Improve transit travel time – Transit in Seattle must improve its ability to get travelers between

Different transit modes and amenities can create a positive experience.

Transit shelters can be designed to add to the urban design.

Providing alternatives to paying at the front of the vehicle may allow for faster boarding and alighting.

two points faster. Exactly how this is accomplished may vary by mode. Priority at traffic signals, queue bypass lanes, transit-only lanes and streets, consolidation of stops, and faster, easier fare collection are some of the leading techniques to speed bus travel. Light rail is a new mode for Seattle, but speed in this mode is accomplished with rational station spacing, exclusive right-of-way, and absolute priority when it is necessary to operate in mixed traffic. Urban street cars are dependant on reasonable allocation of stops and priority treatment in the mixed traffic where it operates. Commuter rail systems face the need for insulation from mixing with freight traffic, grade separation, and track improvements to allow maximum allowable speeds and implementation of operating strategies, e.g. express trains with skip stops, to reduce overall travel times.

Improve Transit Service Frequency – Convenience is a major deciding factor for many people when choosing a mode of travel. If transit operates at high enough frequency with enough capacity, people are more likely to choose transit over an automobile. Conventional wisdom in the transit industry has established fifteen minutes as the minimum frequency of service necessary to begin attracting riders who are making a spontaneous decision to use transit for a particular trip. Beyond that threshold, operating more frequently will attract more "choice" riders to a transit system. Research has shown that transit waiting time, as opposed to time in the vehicle, has two to three times more impact on the transit decision than the actual travel time. [1]

Improve the Transit Operating Environment – For transit to make substantial gains, it must be seen as a positive choice compared to driving. This requires both improving transit options and removing incentives to drive. For example, research has shown that auto commuters will consider alternatives when faced with increases in parking fees. Typically the response is not wholesale conversion to transit. In many cases some will pay the additional costs, some will evolve to ridesharing and some will choose a transit trip, if it is convenient and cost effective to do so. Parking management, is described in detail in Chapter 7 of this Briefing Book.

1 Mohring, H., J. Schroeter, and P. Wiboonchutikula. 1987. The value of waiting time, travel time, and a seat on a bus. Rand Journal of Economics 18 (1):40-56.

Issue #1. What can be expected of a great transit system?

Research has shown that the factors most affecting transit ridership, like density of population and employment, parking supply and cost, degree of urban congestion, availability of roadway capacity, and cost of owning and operating a private auto, are beyond the control of transit systems themselves. But, in the correct environment, offering an optimized mix of services delivered well will result in the maximum use of transit. Below are some areas and examples of actions and activities that have worked in other places.

Improve Reliability and Frequency of Transit Service

- Wide spacing between bus stops to increase operating speeds
- Service frequency that does not require a customer to carry a schedule
- Passenger loading platforms designed to ease bus reentry into traffic streams
- Prepaid tickets and boarding passes to expedite passenger boarding (also eases the fear of "what do I do with the fare box?")
- Low-floor buses with wide doorways to speed boarding and alighting
- Transit priority in mixed traffic (e.g., bus lanes and special signalization)
- Vehicle locator systems to adjust spacing of buses, so that if the schedule promises a bus every ten minutes, the actual operation delivers that promise

Improve Comfort, Safety, and Convenience of Service

- Door to door travel time that is competitive with driving
- Transit vehicles that are not consistently overcrowded
- Expanded service available through a larger portion of the day
- When necessary, convenient, time and space, transfers between modes and routes
- Amenities at transit stops and stations, shelter, seating, lighting, information

Next bus information is especially important on less frequent lines.
Source: U.S. Dept of Transportation

Low floor buses make entry faster and more comfortable for riders.

The transit trip begins with a great walk experience.

Vehicle and information design contribute to customer experence.

Source: World Resources Institute.

- Clean vehicles – new customers expect buses to pass the white glove test
- Knowledgeable drivers – often the first person a new transit customer will turn to for confirmation that they are doing the right thing
- Convenient ticket purchasing places
- Sidewalks leading to stations and secure, lighted waiting areas
- Uniform and simplified fare structures across area transit modes and providers
- Discounted transit passes tailored to individual rider needs
- Widespread publication of schedules and color-coded matching of buses and lines
- Simplified information to make systems more "tactile" to riders
- Special taxi service options to extend and complete the transit network
- Real time information for customers, at stops, on the web, on personal communications devices

Issue #2. What responsibility do other agencies and governments have in making transit more effective?

The literature on making transit work contains many different directions and opinions, but there seems to be one common denominator: forces external to transit play a much larger role in determining the success of the system than the transit agency.

Making Transit Competitive with Private Automobiles

- High automobile taxes
- High motor fuel taxes
- High parking taxes
- Parking limits in city centers and uniform policies throughout the city center
- Street designs that de-emphasize auto access in some downtown environments, such as popular downtown retail districts
- Discounted automobile rentals and car cooperatives sponsored by transit agencies

Making communities walkable or pedestrian friendly makes them transit friendly

- Pedestrian and transit compatible urban land use policies
- Land use decision making shared among local, regional, and national governments
- Regional integration of transportation and land use plans and zoning
- Common rules and guidance on street and site development designs favorable to transit

Issue #3. What about marketing?

The environment, or context, in which transit operates plays a significant role in determining success. The best practices of transit agencies suggest that agencies need to become students of that context. Transit systems need to know the market, tailor services and features to that market ,and communicate as directly as possible with that market. In the most classic business sense it is "marketing." Equally important to remember are some of the lessons learned in marketing: a single ad campaign will produce no lasting bump in market share or sales; continuous messaging to the desired specific market is a necessity to gain, or even maintain, market share; no market is static, what worked last year may provide no success this period. Making transit competitive in the market place? Most auto manufacturers spend significant portions of gross revenue in marketing research, marketing strategy, and marketing media. Transit agencies seldom spend more than 10% of gross revenues on marketing, and marketing is nearly always first to fall when budgets get tight.

Sources:

Krizek, K. A, El-Geneidy, 2007, Segmenting Preferences and Habits of Transit users and Non-users, Journal of Public Transportation, Vol.10, No. 3

Making Transit Work: Insight from Western Europe, Canada, and the United States -- Special Report 257 (2001), Transportation Research Board

Photo Sources:

Unless otherwise sourced, all photos are from the Nelson\Nygaard archives.

Source: World Resources Institute. License: Creative Commons Attribution 2.0 Generic, http://creativecommons.org/licenses/by/2.0/deed.en

Paris busway.

Ticket machines speed boarding.
Source: Wikipedia user "noroton". Public domain.

Best Practices
Transit First

Making Seattle a "Transit First" City

As a city that values its environment, economy and livability, Seattle is increasingly looking to transit as an alternative to the single occupant auto. Regardless of the alternative selected to address the Alaskan Way Viaduct, the city is moving toward a vision to "Get Seattle Moving" that prioritizes movement of people and goods in an environmentally friendly way including increasing the use of transit. A similar, but even more robust concept called **"Transit First"** is fast becoming the policy of cities interested in creating sustainable and livable cities for the future.

Issue 1. What is Transit First?

The transit first concept refers to a comprehensive and coordinated set of policies that mandate or encourage land use and transportation decisions to favor transit (and by extension, bicycling and walking, since these modes are used to get to and from transit) over private automobile travel. These transit first policies strive to make public transit and non-motorized modes more attractive to commuters by giving them priority through policy initiatives (in the form of regulations, ordinances, and laws), financial incentives, design guidelines, and capital improvements

Transit first land use is designed for maximum convenience in transit access and offers denser, clustered, and mixed-use development. Transit first transportation concepts include a wide variety of tools for making transit more reliable and more attractive. (see Issue #3)

Issue 2. What are the Advantages of Transit First Planning?

Urban planners and transit advocates have long maintained that land use (the size, mix, and location of different types of buildings) in a com-

Case Study, Transit First in San Francisco, CA

Consider the experience of San Francisco, where a Transit-First Policy is written into the City Charter. Some have praised San Francisco's Transit-First Policy as a step in the right direction that has led to more enlightened decisions regarding land use and transportation policy. The San Francisco Planning and Urban Research Association (SPUR) has noted that "Were it not for the Transit-First Policy, the City would have followed the path of so many other American cities, widening roads, narrowing sidewalks, demolishing downtown buildings and then filling the spaces with parking garages" (from SPUR's 1999 report Transportation Principles for San Francisco). The International Council for Local Environmental Initiatives (ICLEI) has reported that San Francisco's Transit-First Policy "stresses the critical importance of implementing measures, preserving existing infrastructure assets, and making investments now to reduce motor vehicle dependency".

munity often dictates the type of transportation people will use to get around that community. Critics of existing development patterns in the United States point out that conventional land use practices strongly discourage public transit while favoring the use of personal automobiles. For example, these critics note how in this country, free parking is provided by employers and businesses, transportation funds are mostly directed toward roads and highways, streets are designed to expedite vehicular traffic flow rather than accommodate transit, bicycles, and pedestrians, and zoning regulations insist on strict segregation of land use and excessive amounts of parking, creating long distances between places and further fostering dependence on automotive travel. It is no wonder that use of public transit in the United States is still quite low, accounting for just 1.5% of all trips according to the US Bureau of Transportation Statistics (BTS). Transit first policies can help break this dependence on the automobile, promote more compact development, and reintroduce transit, biking, and walking

Case Study, Transit First in San Francisco, CA (cont.)

A criticism of San Francisco's Transit-First Policy is that it has not been adequately enforced. Critics argue that city officials have only given lip service to the policy, while still allowing projects that encourage automobile traffic. For example, despite having a transit first policy, the city still subsidizes parking in its publicly-owned garages (20% below the market rate prices) and grants approval to massive parking garages in the transit-rich downtown core.

Despite the criticisms, transit first policies in San Francisco have been recognized for yielding significant benefits. For example, transit first policies help explain the findings from the 2000 Census that showed that 55% of all commute to work trips, in the entire city of San Francisco were by transit, bike, on foot, or carpool (compared with just 21% nationally). For comparison, the same data from the 2000 Census for the entire city of Seattle for all commute to work trips finds 39% of these trips were by transit, carpool, walking or biking.

Issue 3. What does a Transit First Transportation System Look Like?

Changes in the design of the transportation system can take the form of physical measures that prioritize transit and non-motorized means on roads and highways. Where inevitable conflicts between auto throughput and transit reliability or speed occur, transit first planning requires that transit has priority. This is not simply a modal bias — transit first is a "shorthand" for prioritizing person-throughput over auto mobility. Some opportunities for transit first improvements include:

- Reserved 'transitway' lanes for buses, trams, and/or light rail vehicles
- 'Bulb-outs', or curb extensions, built out into the parking lane, allowing buses to remain in traffic thus removing the need to re-enter traffic and wait for passing vehicles
- 'Queue jumpers' at intersections — striping the roadway to allow buses to bypass vehicles waiting at red lights by permitting them to advance to the front
- Priority signals that give buses and other transit vehicles green lights before other vehicles
- Narrowed (or 'skinny') streets and low speed limits to discourage automobile speeding and other dangerous driving behavior, while continuing to accommodate the physical size of buses on transit streets
- Streets designed for pedestrians with wide sidewalks, numerous crosswalks, adequate lighting, street furniture (e.g., benches, trash containers) and other pedestrian amenities

Source:

Transit and Land Use Coalition, Instant Advocate, 2004, Transit-First Planning and Funding Policies.

Photo Source:

All photos are from the Nelson\Nygaard archives.

Best Practices
Bus Rapid Transit

What is Bus Rapid Transit and What Can Seattle Expect From it?

Bus Rapid Transit (BRT) is a combination of techniques designed to provide a higher speed, higher capacity, and higher quality service than on standard bus routes at a lower cost than conversion to rail.

Because BRT is actually a combination of techniques it is implemented differently in different places. In Seattle, a full-featured BRT is needed to meet the objectives of addressing traffic congestion, improving air quality and providing realistic travel options for a larger segment of the population.

What is Bus Rapid Transit (BRT)?

BRT is a term that refers to a collection of optimization strategies that increase speed, reliability and carrying capacity of traditional bus transit operations on major streets. BRT systems may employ different combinations of strategies at differing levels of intensity to meet local needs and goals. BRT optimization strategies include:

Exclusive Lanes and Priority Treatments – BRT systems may operate 100% in exclusive right-of-way to achieve the fastest possible operation. Some systems only use exclusive right-of-way to bypass traffic choke points or "jump" past cars queued at intersections. Most BRT systems also interact with a community's traffic signal system to speed passage through busy intersections with the objective of reducing traffic signal delay.

Stations – Stations come in many shapes and sizes, both on the surface and underground. While the transit routes operating in Seattle's Downtown Transit Tunnel are not necessarily BRT services, the tunnel provides a good example of the most sophisticated BRT stations. Station spacing is generally greater than traditional urban bus stop spacing. Typical BRT stations are spaced at

Case Study: Los Angeles Rapid Bus

Source: istockphot.com

18 routes now operating in Metro Rapid Service

Services feature many of the following:

- Bus Signal Priority
- Schedules that communicate "a bus stops here every "x" minutes (e,g, five minutes)
- Less Frequent Stops spaced every .7 miles
- Frequent Service
- Simple Route Layout
- Integrated with Local Bus Service
- Level Boarding and Alighting
- Color-coded Buses and Stations
- High Capacity Buses
- Off-Board Fare Collection
- Partial or Complete Exclusive Lane

Results:

- Average time savings >20% over conventional bus, with heaviest corridors (i.e. Wilshire/Whittier and Ventura) saving almost 30% compared to local bus
- Ridership increases of up to 50% in heaviest ridership corridors with 1/3 of all riders being new to public transit

Case Study: Vancouver 98-B Line

A ten-mile long line connecting Richmond BC (at the airport) to downtown Vancouver.

Route serves four major activity centers:

- Downtown Vancouver with 130,000 employees.
- The hospital district east of the corridor with 40,000 health care and related jobs.
- The airport with 25,000 jobs.
- City of Richmond CBD with 30,000 jobs.

Route is fully integrated with local circulators, local bus, other BRT routes, light rail and commuter rail along its length.

Distinctive shelters provide a high quality, rapid transit-like image for rapid bus. Include vending machines for on-street ticketing and all door loading.

Stops are more frequent in dense areas, less frequent in areas of lower density.

Vehicles are distinctively decorated, but are standard articulated low floor transit coaches.

Design of route saves about 20% of normal bus travel time. PM peak travel times are nearly identical to auto travel times.

Daily ridership is 18,000 boardings per day, about 2,500 per hour in the peak direction. 23% percent of riders previously drove single occupant autos.

Service Reliability has also improved with headway variability cut nearly in half.

distances of one half to one mile apart. Stations usually contain customer amenities such as shelter, seating space, real time information and loading areas, often with level platforms to improve passenger boarding and alighting times.

Vehicles – BRT buses are typically "branded" giving them a distinctive character compared to other buses operating in a community. Sometimes the buses are designed to make them appear to be light rail vehicles and are frequently equipped with power and drive systems that minimize emissions. They have more and wider doors, are often low floor and can have passenger capacities of 100 passengers or more. In American practice to date the vehicles are seldom over 65 feet in length. In some places, like Curitiba, Brazil, where BRT vehicles operate in their own right-of-way, they are up to 82 feet long with seating for 57 passengers and substantial standing room.

Fare Collection – Fare collection systems are designed with the objective of reducing loading times at stations. Some BRT systems have "off-board" fare collection which requires the passenger to purchase a ticket or pre-pay their fare in advance. Others have systems on board designed to be less time consuming for customers than traditional systems where every passenger needs to present fare to the operator.

Service – One characteristic all BRT systems share is high frequency, 15-minute or less service that operates throughout the day and well into the evening. Efforts are typically made to simplify routes and schedules to the point that a passenger does not need a schedule to use the system convieniently. Service is often enhanced by the presence of technology to inform customers when the next bus will depart or even send a notice to their cell phone or computer when their BRT is leaving a particular station in five minutes.

Other considerations – BRT systems are often selected for environments where it is preferable to establish service quickly and at less cost than a rail system. BRT may be a first stage of development leading towards rail, or an end in itself. Often BRT systems are implemented in stages where one part of the system meets the design standards of a BRT while other parts of a corridor may continue to operate like a typical urban bus route. BRT systems have the capability of flexible

operation in areas with challenging topography. Finally, BRT systems cost less to build. Heavy rail systems cost $150 to $250 million per mile, light rail systems range from $25 to $75 million per mile, urban street cars range from $12 to $25 million per mile and BRT systems can be constructed for $3 to $25 million per mile.

Is BRT just a fad?

BRT has become an overused term. It is easy to use the term BRT to call attention to any new transit service that may be designed to have some distinguishing characteristic. True BRT systems are another tool for communities who desire to provide transit service that is faster and more attractive than typical urban bus systems.

What other communities have BRT?

In the U.S., BRT systems are operating in Los Angeles, Boston, Las Vegas and Eugene, Oregon. Vancouver, BC has a good example of BRT. BRT systems are being planned or constructed in Cleveland, San Francisco, New York, Boston, Houston and Seattle.

What BRT is planned for Seattle?

With funding in hand from the Transit Now initiative, King County Metro is designing their BRT systems, branded as "RapidRide" on:

- Aurora Avenue N. between Shoreline and downtown Seattle
- Ballard to downtown Seattle along 15th Avenue N.W. and W. Mercer Place
- West Seattle to downtown Seattle with a possible extension to the University District using the downtown transit tunnel and Interstate 5
- Bellevue to Redmond on N.E. 8th Street and 156th Avenue N.E. via Crossroads and Overlake
- SeaTac to Federal Way on Pacific Highway S. (State Route 99)
- Also under consideration, but not currently funded, is a BRT on the SR 520 bridge as part of the reconstruction proposal. The precise terminal locations of this service have not yet been identified and the system could have more than one branch on the west side of the lake

Vehicle design creates identity, increases comfort and contributes to reducing delays.

Bus only lanes speed BRT.

Sources:

Breakthrough Technology Institute.

King County Transit Now Initiative.

98 B-Line Bus Rapid Transit Evaluation Study, Transport Canada, 9/2003.

2007 New Partners for Smart Growth Conference Proceedings, Presentation by Rex Gephardt on LA Metro Rapid.

Photo sources:

Unless otherwise noted: all photos are from the Nelson\Nygaard archives.

Best Practices
Urban Streetcars

What is the Role for Urban Streetcars in Seattle?

Early in the 20th century most urban areas in North America were served by extensive streetcar networks. The streetcar was the primary tool of real estate developers working to ensure that new residential communities in expanding cities would be accessible to jobs and shopping in downtown areas. In the 1940s and early 1950s streetcar systems in Seattle and throughout the country were phased out, replaced by rubber-tired buses that were considered quieter and more flexible than streetcars.

Now faced with ever increasing central city congestion, and a need to rebuild, redefine and redevelop central cities and adjacent neighborhoods, many cities are returning to the idea of streetcars to both provide access and spur economic development. Seattle is not an exception to this trend. In the early 1980s Seattle was one of the first to put streetcars back on the map with development of the historic Waterfront streetcar line. Redevelopment of the South Lake Union area led to the construction of Seattle's second streetcar line from Westlake Plaza to the Fred Hutchison Cancer Institute.

Why streetcars?

One of the driving forces behind the streetcar renaissance is the fact that an investment in streetcar infrastructure provides a permanent positive indication of access and connectivity, usually from a close-in neighborhood to the urban core. Unlike bus routes which can change frequently and are more difficult to decipher, streecars provide an indication of permanance and a physical reminder of where service is provided. This type of investment, unlike simply adding bus service, has been proven to accelerate and organize development, and in many cases, including Seattle, encourages private investment in the public transit.

Source: Nelson\Nygaard

Case Study: Portland, Oregon

The Portland Streetcar has been credited with increacing property values along the streetcar line by 40%, and attracting up to $3 billion in private investment. While much of this investment might have happened without the streetcar, the new line expedited and shaped the new development patterns, producing a clear positive return on the public investment in the line. With ridership approaching 9,000 boardings per day, the city has recently extended the streetcar from the campus of Portland State University into a rapidly redeveloping area along the south waterfront. This includes an interface with an aerial tram system that connects the streetcar with a major medical facility on the bluff some 300 ft. above the rail tracks. Under consideration is an extension of the streetcar system to the east side of the Willamette River to better connect dense neighborhoods with downtown Portland.

Streetcars easily share the road with other ground transportation options, such as bicycles, buses and cars, instead of requiring their own lane or right-of-way. This increases public transit capacity without impacting other options. While streetcars can "share the lane" they often do have their own right-of-way or other priorities to ensure higher speed operation.

Streetcars can be constructed quickly. For example, Mayor Nickels proposed the South Lake Union Streetcar in 2003, and the Seattle City Council approved the project in 2005. Now, just two years later, the South Lake Union Streetcar will begin operations. New streetcar construction techniques, developed in Portland, ensure very fast, low impact construction, which is unique among rail modes.

Isn't a Streetcar the same as Light Rail?

While both run on rails there are distinguishing characteristics which make them different and optimal for different applications.

- Right-of-Way:
  Streetcars: Can operate on either mixed right-of-way, street level operation or exclusive lane if available.

  Light rail: Requires mostly exclusive right-of-way.

- Stop spacing:
  Streetcar: Usually designed for "short hops" with stops every few blocks or one-quarter to one-half mile apart.

  Light rail: Longer spacing to encourage higher speed operation with stops every one-half to one mile.

- Vehicles:
  Streetcar: Short single car operation. Modern vehicles are approximately 60 ft. long and carry 100 to 120 people. Historic cars are usually shorter, from 40 up to 60 ft. with capacities of 50 to 60 people.

  Light rail: Longer cars (around 90 ft.) often operated as multi-car trains with capacity for up to 180 people per car.

Case Study: Tacoma, WA LINK

A 1.6-mile line, the Tacoma streetcar was built to light rail standards, but operates as a streetcar system. The line connects the Tacoma Dome Station, a regional multimodal hub with Sounder Commuter Rail, regional and local bus service. The Tacoma Dome station offers 2500 free parking spaces allowing for park-and-ride operation. The Dome shopping and restaurant district, the Museum District, the University of Washington Tacoma Campus, the Tacoma/Pierce County Convention and Trade Center, the Theatre District and Antique Row as well as several major downtown office buildings are within short walking distances from the stations. In 2006 ridership totaled 885,000 with nearly 3,000 per day using the LINK to travel between locations along the line. The route operates fare free. The system was designed to enhance economic development opportunities in Tacoma. Ridership has consistently exceeded the original forecasts for the route.

Source: Seattle Streetcar Network and Feasibility Analysis 6/2004

- Route Distance:
  Streetcar: Short, urban environment, usually around five miles, but longer streetcar lines do exist. Initial route segments for new systems have been two miles or less.

  Light rail: Long, more regional, usually more than 10 miles built at a time; often connecting suburban and urban areas.

- Functions and Market:
  Streetcar: Local circulation either as a supplement or a replacement for bus services.

  Light rail: Longer trips, more regional in character.

- Construction Costs:
  Streetcar: About 25% of equivalent light rail. Track bed requirements are less costly and overhead wire installation is simpler.

  Light rail: Built to higher standards due to higher speeds and greater weight of the vehicle and passengers. Light rail is often built on exclusive right-of-way and is sometimes fully grade separated, all of which increase construction costs.

- Speed:
  Streetcar: Slower than light rail when operating in shared right-of-way with frequent stops.

  Light rail: Designed for speed and less frequent stops.

- Efficient carrying capacity:
  While the overall carrying capacity of a line is determined by travel time, reliability and frequently; the number of passengers that can be carried by a single driver affects the efficiency at which large numbers of riders can be carried.

  Streetcar: Generally one car per "train" carrying up to 120 people, although some systems are designed to allow multiple car trains. Requires high frequencies to be considered "high capacity" at a higher cost per passenger.

  Light rail: Often multi-car "trains" with a single operator carrying 500+ passengers.

A key distinction between light rail and streetcars is that light rail trains often have several or many individual cars connected together with a single operator. This makes them relatively inexpensive to operate on a per passenger basis. Generally, light rail can be considered "high capacity transit" because multiple cars are operated on a single train with a single operator moving many people at one time. Light rail is also "high speed transit" because it generally operates in its own right-of-way, unaffected by surrounding congestion, and has wide stop spacing that keeps the train moving.

Source: Seattle Streetcar Network and Feasibility Analysis, 6/2004

Case Study:
Toronto, Ontario, Canada

Toronto has eleven streetcar lines, 10 of which travel through downtown Toronto; three of those lines share space with the subway system. The lines represent a mix of old and new technology and are closely integrated with Toronto's subway and bus systems. Ridership on the streetcars alone is about 150,000 boardings per weekday.

Streetcars, on the other hand, generally operate as single cars, more like an articulated bus in capacity. To be considered "high capacity" streetcars would need to operate at high frequency.

Streetcars are designed to fit into urban streets and often share the right-of-way with cars and buses, so streetcars are much more likely to be affected by general congestion. However, as with any transit mode, this can be addressed in selected or the most congested locations with treatments such as signal priority and/or exclusive queue-jump lanes. Streetcar stop spacing is generally much closer together than light rail, because streetcars serve as circulators for short trips rather than serving longer distance "line haul" travel. While it is possible to move many people on streetcar systems using high frequency and multiple car trains most streetcar systems are designed and intended to operate at a lower level of intensity to facilitate shorter urban trips in high density areas.

Both streetcars and light rail benefit from being rail services. The added legibility and permanence of having rails on the street seems to boost ridership, and many riders find a ride on rails to be

more comfortable than a rubber-tired bus. The combination of streetcars integrated with a light rail system, provides the added benefit of known station locations where people have greater confidence that transfers between the systems will occur seamlessly.

Why not just use buses with improved service?

Streetcars can organize development, often generate private financing, attract tourists and occasional riders, offer "legibility," and operate better in pedestrian environments. Research has shown that with all other characteristics being held equal, replacing a bus line with a streetcar will typically increase ridership by as much as 40%. This is primarily due to the ability of streetcars to attract more regular riders, including commuters, due to the quality of the ride, higher reliability, known destination and improved image of a streetcar versus a bus. Passengers frequently cite comfort in the quality of the ride as a reason for choosing to ride a streetcar versus a bus. Modern streetcar propulsion and suspension systems offer a ride that is similar to the smoothness of light rail and heavy rail.

Creating a streetcar line still costs much more than running better bus service and requires a clear "permanent" route unlike bus service. Usually, cities do not build streetcar lines solely for ridership reasons. Cities build new streetcar lines because of streetcars' unique ability to organize development and catalyze economic development strategies while increasing transit ridership and attracting riders who might be reluctant to ride a bus.

How might streetcars be successful in Seattle?

In 2006 the city of Seattle completed a study of possible streetcar routes in the city. The result of that work is summarized below.

Corridors where streetcars can be successful have the following characteristics:

- Because they are slower and lower capacity than light rail, streetcars tend to be more successful on relatively short corridors, typically running no more than 3-5 miles from the central business district.
- Streetcars thrive in locations where there are many short trips, particularly convenience trips. So they work best in corridors with a rich mix of uses, including retail, employment, residential and institutional uses.
- All transit relies on density for success, since increased density results in a larger potential rider market, which results in greater frequency, which in turn results in even higher ridership. Because of their higher costs, streetcars need higher density than buses to be successful.
- In order for passengers to walk to and from streetcar stops, the entire corridor must have a high level of walkability.
- The most effective streetcar lines generate high all-day ridership in both directions, requiring a strong terminus on at least one end of the line and ideally both ends. One end will almost certainly be Center City, ideally one of the major hubs there: King Street Station, Colman Dock and/or Westlake Center. The other end can be a major destination like Seattle Center, a neighborhood shopping street and/or another primary transit line.
- To allow for operational efficiency, a new streetcar should replace all or part of an existing bus line.
- Successful streetcar corridors have existing, strong economic development potential and a clear economic development strategy.
- Finally, successful corridors have a plan in place to capture part of the real estate value streetcars create – and ensure that existing residents and businesses are not displaced by rising rents and property values.

The map on the following page shows possible streetcar alignments for Seattle that came from a workshop on the role of streetcars in Center City. The routes shown, while conceptual in nature, clearly demonstrate how streetcars can effectively integrate dense portions of the city with LINK light rail and provide important new fixed links in the Center City transportation infrastructure.

Sources:

Seattle Streetcar Network and Feasibility Analysis, 6/2004

Seattle Center City Streetcar Workshop Report, 1/2007

Figure 1 Recommended Plan Map

Source: Nelson\Nygaard

Best Practices
Light Rail

What is Light Rail and How Can it Be Applied in Seattle?

Light rail is a hybrid of conventional commuter rail, which operates heavy trains on standard freight guage track, usually with multi-car trains and stops spaced more than a mile apart; and urban streetcars which can operate in mixed traffic, with single cars and close stop spacing. While each system is different, light rail operates multi-car trains, usually with electric power (either overhead or third rail) with stops generally half a mile or more apart. Light rail is more suited to an urban environment than heavy commuter rail, but provides more capacity and generally faster travel times than streetcars. Use of light rail in North America has grown significantly in recent years with new light rail lines built in 18 U.S. cities since 1980.

What is planned for Seattle?

In 2009 Sound Transit will begin operation of a 15.6-mile light rail line between downtown Seattle and Sea-Tac airport with 13 stations along the route. The system will operate jointly with buses in the downtown transit tunnel and have exclusive, grade separated, right-of-way through much of the length of the line. Sound Transit's system is estimated to travel at an average 28 miles per hour, including stops. This design has three primary benefits: system reliability; travel times that are competitive with equivalent trips by auto and the ability to increase capacity by operating vehicles frequently — as little as two minutes apart; and operating up to four cars per train. In 2008 Sound Transit will begin construction of a 3.15-mile extension that will connect downtown Seattle with the University of Washington via a tunnel. The extension will have two stations, one on Capital Hill and the other at the University of Washington. (See Figure 1)

Source: Nelson\Nygaard

Case Study: Portland

Portland's Max line first started service in 1986. The MAX system has been extended three times with another two extensions under construction scheduled to open in 2009. Another extension is in design to be constructed by 2014. With weekday ridership of over 107,000 boardings in 2007, MAX is the fifth most ridden light rail system in the United States ranking very close to the system in San Diego. About $3 billion has been invested in 44.3 miles of light rail in Portland. Portland has made a distinct effort to connect transportation and land use planning.

In November 2007, voters rejected a Phase II expansion of light rail that would have extended the core system south to Tacoma, north to Lynnwood, and east to Bellevue, Overlake and Redmond crossing Lake Washington on the I-90 Floating Bridge. These corridors are defined in Sound Transit's Long Range Plan, and another proposal to extend the light rail system will likely be presented to voters again in the future. (See Figure 2)

If an expansion is approved by voters some, or all, of the expansion lines listed above could be constructed by 2030.

What can light rail do for Seattle?

When light rail begins operating in 2009, trains will operate every six minutes during peak hours, and every 10 to 15 minutes in midday periods and evening hours. Ridership on the initial segment from Downtown to Sea-Tac is expected to be 42,500 per day by 2020. The extension to the University of Washington is expected to generate an additional 70,000 riders per day by 2030, bringing system ridership to more than 112,500 daily boardings in 2030. If the line is extended to Northgate, ridership is projected to top 150,000 boardings per day in 2030. This would mean that, at the Ship Canal, light rail trains will have the equivalent people moving capacity of five freeway lanes on I-5. At Spokane Street the light rail system has the potential to provide nearly four equivalent freeway lanes of people moving capacity.

The regional light rail system will provide significant new people moving capacity into Center City. The system will also provide a firm foundation for building other transit investments that will provide even more mobility options for people traveling to and from Center City.

Source: Sound Transit

Source: Nelson\Nygaard

Case Study: San Diego

The San Diego Trolley, launched in 1981, demonstrated that rail transit can attract increasing numbers of riders, even in a sprawling, heavily automobile-oriented American city., Average weekday boardings in June 2007 reached 108,873 – a 5.1% increase from the same period in 2006.

The San Diego system consists of three lines totaling 51 miles and was built between 1981 and 2005. This system is frequently cited for being a cost-effective implementation of light rail. The system was a beneficiary of low cost right-of-way, as much of the system's tracks were built on top of old railroad rights-of-way and in some parts of the system still share track with freight rail. This light rail system is not connected to some major travel generators in San Diego like the airport and the public beaches. Land use along the tracks remains fairly low density.

Sources:

Sound Transit

Tri-Met

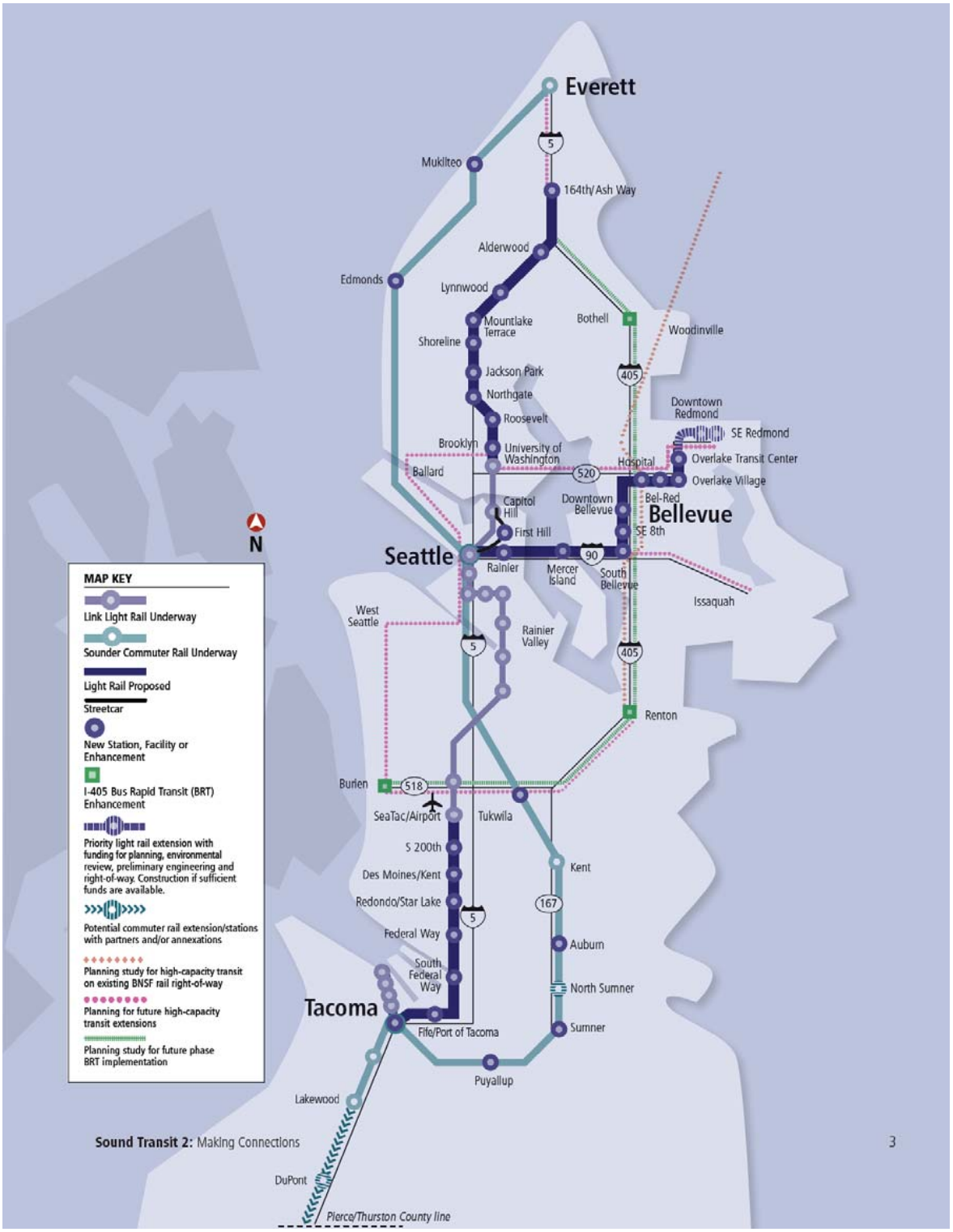
San Diego Association of Governments

Wikipedia – Light Rail Systems Ranked by ridership

Figure 1 Sound Transit Light Rail Under Construction

Source: Sound Transit. Permission for use granted by Bruce Gray, Sound Transit Media Relations, via email 1/4/2007

Figure 2 Sound Transit Long Range Transit Plan, adopted 2006



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