Passenger Rail Primer

Thurston Passenger Rail Workgroup
November 2005

Passenger Rail Characteristics

This document is intended as a primer introducing and familiarizing the reader with the basic definitions of passenger rail and providing a comparison of common transit services in 2005. It was developed to facilitate a discussion of passenger rail and other transit options in the Thurston Region, in preparation of a regional rail plan.

In the next section, *Passenger Rail Overview*, the fundamental characteristics of light rail, commuter rail and intercity rail are covered. *Complementary and Alternative Transit Options* (primarily common bus transit choices) provides a wider transit context within which the passenger rail modes coordinate and compete. After investigating transit options individually, they are compared and contrasted in a chart of their characteristics, *Summarizing the Continuum of Services*. *Other Rail Transit Technologies* provides a brief overview of less extensively used rail options and the *Appendices* provide additional details and information.

Additional resources the reader may want to consult include:

- The American Public Transportation Association (APTA) website at www.apta.com
- The Victoria Transportation Policy Institute (VTPI) website at www.vtpi.org
- Bureau of Transportation Statistics (BTS) website at www.bts.gov

Passenger Rail Overview

Introduction

Passenger rail modes may be distinguished from one another based on a variety of characteristics – level of service, technology, right-of-way and operations. These characteristics are discussed in more detail in the other sections of this chapter. Like other transit services, however, in the most basic sense passenger rail modes break down by three distinct geographies – local, regional, and statewide or interstate.

Local rail – typically light rail or metro (rapid or heavy rail) – operates within an urban area providing transit services among many stops serving the metropolitan hub. In this sense, it is a *many-to-many* service with multiple stops in the central business district and perhaps other commercial centers, neighborhood centers and intermodal transportation points (airport, commuter rail and bus stations). Some examples include Sound Transit's light rail service in Tacoma, and familiar metro examples from New York, Washington, D.C., Paris, and London.

Regional rail – referred to as commuter rail – provides *many-to-one* service by bringing commuters from suburbs to a central business district, typically with only one or two stops in the central business district and at each suburban node along the rail line. The stops in the central business district may be intermodal hubs providing commuters with connections to the local transit system (rail or bus), while the suburban intermodal connections may include park-and-rides and local or commuter bus service. The Sounder linking suburban cities like Auburn and

Kent to Seattle provides such a commuter service, as do the several commuter lines serving New York City – the Long Island Railroad, New Jersey Transit, and Connecticut Commuter Rail.

Intercity rail serves larger statewide and interstate needs with *one-to-one* service between cities. Typically intercity rail serves both business and leisure travel over longer distances that compete with long distance automobile or airplane trips. Such rail service typically makes one stop at each urban node along the chain of stops crossing one or more states. Amenities are typically more comfortable on intercity rail service – softer seats, sleeping accommodations, dining cars, observation areas – than on characteristically more Spartan local and regional rail service. Familiar examples serving the northwest include Amtrak's Cascades (Vancouver, BC to Eugene, OR), Coast Starlight (Seattle, WA to Los Angeles, CA) and Empire Builder (Seattle, WA to Chicago, IL).

While each mode tends to reflect local, regional or interstate geographies, in some communities a single mode serves multiple needs. For example, in some communities light rail and metro may extend beyond the urban core into the suburbs for a few miles. Such a system not only serves as frequent stops placed close together in the central city, but also serves to bring commuters into work from suburban communities. The light rail system in Portland and the metro rail systems in Chicago and Washington, D.C. are examples.

Intercity rail may also provide commuter service for some passengers, however, such a system is often limited by several factors. Intercity rail service is not necessarily scheduled to coincide with peak period commuter travel and may present limited travel options. With its additional amenities and greater distances between stops, intercity rail may also be more expensive than traditional commuter rail or other commuting options. Also, because of the distances involved and limited access points, fewer commuters are usually candidates for considering this travel option. The Thurston region has another consideration – the location of Centennial Station, the only station between Vancouver, B.C. and Eugene, OR (the Amtrak Cascades corridor) that is not located in or near the central business district. This makes it inconvenient for many in- and outbound commuters to reach their work places in consistent and timely ways.

Light Rail

Light rail, sometimes known as streetcar, tramway or trolley, is a system of lightweight passenger rail cars operating on fixed rails. These cars operate singly or in short (usually two car) trains. Typically the cars have electric motors, drawing power from an overhead power line using a trolley or pantograph. Light rail usually operates in a non-exclusive (shared or adjacent) right-of-way with automotive traffic and perhaps pedestrian traffic for much of its system.

Light rail typically provides local service analogous to local bus service where stops are every few blocks – one-half to one mile. It is called "light" rail because the system carries a light volume of traffic compared to heavy rail.

Heritage or vintage trolley cars are light rail cars build before 1960 or modern replicas of such cars.

In fiscal year 2003, the United States had 27 light rail systems. The average fare per unlinked trip was $0.68 and the average trip length was 4.4 miles. Light rail systems averaged a speed of approximately 16 miles per hour.

Metro or Heavy Rail

Like light rail, *heavy rail* (also known as metro, subway, rapid transit or rapid rail) provides local service, but within a densely populated city with heavy volume of rail traffic. These electric railways operate at high speeds with rapid acceleration on grade separated right-of-way. They use sophisticated signaling and high platform loading. Some systems, converted to full automation with no onboard personnel, are considered automated guideways (see the section on *Other Transit Technologies*).

In fiscal year 2003, 14 agencies operated heavy rail systems in the United States. The average trip length was 5.1 miles and the average fare was $1.00. Speeds averaged 20.6 miles per hour.

Commuter Rail

Commuter rail provides urban passenger train service between suburbs and a central city, with one or two stops in the central business district. It may also provide additional service within the central city. This regularly scheduled service uses electric or diesel locomotive hauled or self propelled railroad passenger cars. Generally, commuter rail travel uses multi-trip tickets, station-to-station fares, and railroad employment practices. More than 50% of the average daily ridership travels on the train at least three times a week.

Twenty-one agencies provided commuter rail service in the United States in fiscal year 2003. The average fare was $3.79, the average trip was 23.3 miles and the average speed was 31.7 miles per hour.

Complementary and Alternative Transit Options

Passenger rail systems don't stand alone in the transit model, but are supported by and may compete with a variety of bus services. Local bus service that feeds both rail and primary bus routes, and, together with support facilities like park-n-rides, is an essential component of transit system. Express bus service and bus rapid transit may compete with or complement local and regional rail service.

Local Bus Service

Local bus service typically stops every block or two along a route several miles long. If the service is limited to short distance trips or serves a small geographic area it is often called circulator, feeder, neighborhood, trolley or shuttle service. Such service may operate in a loop and connect to more major bus or rail routes.

Express Bus Service

Express bus service typically serves more heavily traveled corridors or destinations, especially during peak commuting hours. This service speeds up trips by operating longer distances between stops. For example, express bus service often connects suburban park-n-ride lots to the central business district. Some bus service may be hybrid – with a route acting as local bus service in the urban core and express service between the core and distant park-n-ride locations. Express bus service operating in the same corridors as primary rail lines may be an alternative to commuter rail.

Bus Rapid Transit

A type of frequent but limited stop service, bus rapid transit (BRT) can operate on exclusive bus/transitways, high occupancy vehicle lanes, expressways or ordinary streets. BRT combines intelligent transportation systems technology, priority for transit, vehicle amenities and rapid and convenient fare collection to substantially upgrade performance. Peak period headways are typically quite short for BRT and systems are usually integrated with other modes of transportation, especially transit (such as local bus service and passenger rail service). BRT, depending on its configuration within a community, could be an alternative to light rail and commuter rail, potentially operating within a community to connect neighborhood, business and intermodal centers or between suburbs and a central business district.

Other Rail Transit Technologies

Personal Rapid Transit

Also known as automated guideway transit or people mover, this form a transit is an electric railway operating on exclusive right of way, staffed or unstaffed. It may provide fixed schedule or demand responsive service activated by a call button. The system may operate with single or multiple car trains that carry only a handful to several dozen passengers at a time. These systems are often used at airports and hospital campuses.

Maglev

A maglev train uses electro-magnetic levitation, guidance, propulsion and control systems to hover above the guideway. Train doesn't physically contact the guideway, except when at rest, eliminating friction and allowing the train to travel at great speeds (upwards of 300 miles per hour). Because of the speed, maglev trains would compete with longer distance travel by car, bus, train or air. Currently, Germany and China have operating maglev systems.

Monorail

Monorail is comprised of a single or multiple car electric train that is suspended from or straddles a single beam, rail or tube guideway. If the trains don't have a crew on board they are

considered automated guideway transit. In the U.S., monorails are most typically found in amusement parks – the only two transit monorails operating in the U.S. are in Seattle and Las Vegas.

Land Use and Rail

Transportation and land use are closely related. In the case of passenger rail, fixed rail infrastructure can contribute to commercial land use investment near rail stations because the route is unlikely to move away from the station. Bus rapid transit with exclusive right of way may also have similar cache.

The type of land use that has developed in other communities around urban and suburban rail stations serving commuters includes a range of mixed uses – denser housing, small to large businesses, and retail services (dry cleaning, child care, small retail, restaurants). An example is the renaissance of Freight House Square in Tacoma.

Public investment in infrastructure can precede development – as an incentive to certain kinds of development, or follow development – to address the need for service. For example, cities may invest in sidewalks or sewers in advance of growth in order to direct and encourage it. Or they may come concurrent with growth – or even follow it – to meet a proven demand.

With transit, certain land use densities are associated with the ability to sustain service. Densities increase generally with the frequency of service, capacity, speed and surety of service (fixed versus adjustable). The table below provides some general rules of thumb for different types of transit service. Land use is expressed in dwelling units, but it is generally recognized that as density of dwellings increase so too must employment and services for a more intensive transit alternative to be sustained.

Service	Frequency	Coverage	DU/Acre
Local Bus	Hourly	½ mile between routes	4
Local Bus	Half-Hourly	½ mile between routes	7
Express Bus	Frequent peak period	?	15
Light Rail/Trolley	5 minute peak	25-100 sq mile corridor	9
Rapid Rail	5 minute peak	100-150 sq mile corridor	12

DU = Dwelling units.

Source: Nelson\Nygaard Consulting Associates, 2002, per Pushkarev, B.S. etal, "Urban Rail in America – An Exploration of Criteria for Fixed Guideway Transit," 1982.

Summarizing the Continuum of Services

	Local Bus	**Light Rail**	**Heavy Rail**	***Bus Rapid Transit***	**Commuter Rail**	***Express Bus***	***Intercity Bus***	**Intercity Rail**
Type of ROW	Non-exclusive road	Non-exclusive fixed rail	Exclusive fixed rail	Exclusive bus or transitway, HOV lanes, expressways or ordinary streets	Exclusive fixed rail, may share with freight rail	Non-exclusive roadway	Non-exclusive roadway	Exclusive fixed rail, usually shared with freight rail
Motive Power	Diesel or electric	Electric, often trolley	Electric	Diesel	Diesel or Electric	Diesel	Diesel	
Network	Local	Local	Local	Local or Regional	Regional or Local	Regional	State and interstate	State and interstate
Typical distance between stops	1-2 blocks	¼ - 1 mile	1 mile	Limited	Several Miles	Several Miles	Often 20-100 miles	Often 20-100 miles
Minimum Peak Scheduled Headway	10-60 minutes	6.2 min. (2-15)	4.5 min. (2-8)	10 min. or less	30 min.	15-30 min.	Daily or less often	Daily or less often
Average operating speed	12.7 mph	20 mph [16] (8-35)	20mph [27]		30-50 mph	Posted Speed Limit	Posted Speed Limit	50-79 mph
Maximum operating speed		48.5 mph (20-65)	59 mph (45-80)			Posted Speed Limit	Posted Speed Limit	
Weekday Passenger Volumes		62, 900 [38,000] (4,000-265,000)	728,800 [565,200] (12,800-5,977,200)		62,700 (1,000-326,700)			
Average Trip Length	3.7 miles	4.4 miles	5.1 miles					
Average fare	$0.75	$0.68	$1.00 [$1.50]		$2.00 - $4.00	$1.50-$3.00		

The Urban Transportation Monitor, “Characteristics of Light Rail in USA, Canada,” September 3, 2004.
The Urban Transportation Monitor, “Characteristics of Urban Heavy Rail Systems in the U.S.,” January 23, 2004.
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Train Web website www.trainweb.org.
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