4.1.5 TR-5 Light Rail Transit

Description:

Light rail transit (LRT) is more flexible than other rail systems, and can operate in shared vehicle lanes in city streets, in barrier-separated lanes on urban arterials, in freight railway corridors, or on its own exclusive track. It uses electrically powered rail cars, and has been implemented in many American cities. Cities with LRT typically range in population from one to three million people. On a per mile basis, LRT typically costs between $20 million and $80 million per mile. The cost of LRT typically depends on station geometrics, whether existing right-of-way is already owned by the constructing agency, and how much of the rail line is elevated, at-grade, or underground. **Figure 4-5** shows a typical 2-car light rail train.

Figure 4-5. Light Rail

LRT passes the Step A questions because it could:

1. Decrease vehicle demand within the Bridge Influence Area by increasing transit capacity and providing an exclusive guideway that would not be used by private automobiles. Its operating characteristics allow it to serve both short and long trips.
2. Improve transit travel time and reliability by completely separating LRT trains from other traffic.

4.1.6 TR-6 Streetcar

Description:

Streetcar transit is similar to LRT and can operate in shared vehicle lanes in city streets, in separated lanes on urban arterials, or on its own exclusive track. It uses electrically powered rail cars, and has been implemented in San Francisco, Portland, Tampa, Tacoma and other U.S. cities. Cities with streetcars typically range in population size from one to three million people, although some smaller cities have developed short streetcar segments as historical tourist attractions. On a per mile basis streetcar transit typically costs between $25 million to $50 million per mile. The cost of streetcar transit typically depends on station geometrics, whether existing right-of-way is already owned by the constructing agency, and how much of the rail line is elevated, at-grade, or underground. Compared to light rail, streetcar transit typically has the following differences:

- Streetcars have lower top operating speeds. Thus, streetcars are not typically used for long distance commuting, as other rail modes are better able to capitalize on long sections of track with no stops. Streetcar is typically an intra-urban mode with two to three block station spacing, whereas light rail is typically used as an inter-urban mode with half-mile or greater station spacing.

- Streetcars typically operate in general purpose traffic lanes while light rail typically operates in exclusive trackway, although this is not always the case.
- Streetcars usually have less passenger capacity than light rail vehicles. In Portland, each streetcar carries a maximum load (including standees) of 140 passengers, compared to 166 for a loaded LRT vehicle. LRT service is usually provided by two-vehicle trains, whereas streetcars usually operate as single trains to complete tight turns in urban areas and to minimize parking reductions.

Figure 4-6 shows a typical single-car streetcar.

Figure 4-6. Streetcar

Streetcars pass the Step A questions because they could:

1. Decrease vehicle demand within the Bridge Influence Area by increasing transit capacity and providing an exclusive guideway that would not be used by private automobiles.
2. Improve transit travel time and reliability by completely separating streetcars from other traffic. This critically assumes that it is possible to interline streetcar and LRT service on the same trackage (i.e. in the Interstate MAX corridor).

4.2 Components that Fail Step A

This section describes the transit components that do not pass the Step A screening. Each of these transit components has its optimal niche and in some cases has been implemented successfully in specific locations around the world. In the context of the CRC study area and the Portland-Vancouver region, however, they are not promising transit components. In general, these components would not interface well with the existing transit systems that are in place (i.e., they fail Question #2), and for them to be viable, the region would have to implement them on a scale far in excess of what the CRC project could adopt. Conversely, the segments of these transit modes that *could* be implemented as part of this project would not have sufficient "independent utility" to make the investment worthwhile.

More details regarding these modes and their respective features, strengths, and weaknesses follow. The cost information included in this section is for informational purposes only; capital and operating costs are not criteria used in the Step A screening.

4.2.1 TR-7 High Speed Rail

Description:

High speed rail is an inter-city transit service that operates primarily on a dedicated guideway or track not used by freight trains with typical train speeds over 150 miles per hour. Examples of high speed rail systems are found in Europe and Asia where trains routinely travel in excess of 170 mph. High speed rail systems are typically used to connect metropolitan areas ranging from 3 million to over 15 million people. Amtrak operates a form of inter-city high speed rail in the Northeast Corridor (Washington D.C. to New York and Boston), but its Acela service in the corridor typically has travel speeds below 125 miles per hour. A more local example is the Amtrak Cascades route in the Pacific Northwest connecting Eugene, Oregon and Vancouver, BC, although this service only travels at 79 mph - not fast enough to officially qualify as high speed rail. High speed rail requires special grade crossing restrictions. The capital costs of constructing a new high speed rail system can range from $50 million to more than $200 million per mile, depending on the location and specific engineering required by the site. **Figure 4-7** shows a high speed rail train.

Figure 4-7. High Speed Rail

Rationale for Not Advancing:

High speed rail fails Step A Questions #1 and #2. High speed rail is a proven technology but is designed primarily for long, inter-city or inter-state trips with few stops. High speed rail lines often compete with airlines for passengers traveling 200 miles to 300 miles and where travel times between airplanes and high speed rail are roughly equal. In a hypothetical application in the Pacific Northwest, such a system would likely only have one stop in Salem, one stop in Portland/Vancouver, and one stop in Seattle, for instance.

Given that the average bi-state trip within the region is about 15 miles, high speed rail could not advantageously serve many of the identified regional travel markets (e.g., downtown Vancouver, Hayden Island) because it could not achieve high travel speeds between stations that may be located only a few miles apart. A local high speed rail service would likely have very few stops or stations, and perhaps no stops within the Bridge Influence Area, and thus would not actually carry many passengers for local trips. Finally, in order to improve existing transit service in the Bridge Influence Area, it would have to be integrated with the existing bus and rail network, which is infeasible; the technology would require a completely grade separated right-of-way within the Bridge Influence Area and beyond. For these reasons, high speed rail is not an appropriate public transportation component for the Bridge Influence Area.

4.2.2 TR-8 Ferry Service

Description:

A ferry is a passenger-carrying marine vessel providing passage over a river, lake, or other body of water for passengers, vehicles, and/or freight. Ferries were especially important in the days before permanent bridges and tunnels were constructed across bodies of water. At first, most ferries were small boats or rafts, propelled by oars or poles and sometimes assisted by sails. A modern ferry system currently serves various points in the Puget Sound area in Washington, but provides service to only those points where a bridge or tunnel system does not exist. The average travel distance of a ferry route varies from between 10 miles and 500 miles. **Figure 4-8** shows a typical ferry service.

Figure 4-8. Ferry Service

Rationale for Not Advancing:

Ferry service fails Step A Questions #1 and #2. Ferries are most ideal for longer distance travel with no intermediate stops, because docking and de-boarding add significant travel time. The travel time for a ferry service connecting downtown Vancouver to downtown Portland, for example, would likely be slower than the slowest land-based transit bus, even in the congested I-5 corridor, since the service would have to travel many miles out of direction to access the Willamette River. The service would have little or no connectivity to smaller markets and connecting transit services, and likely would not even serve intermediate but significant transit markets such as North Portland. Due to slow travel times and few docking stations, the service would carry relatively few passengers.

In order to improve existing transit service in the Bridge Influence Area, it would have to be integrated with the existing bus and rail network, which is infeasible. The technology would require a new category of infrastructure, and siting the land-based facilities would be challenging, as would accessing the terminals with fixed-route transit. For these reasons, ferries are not an appropriate public transportation component for the Bridge Influence Area, although ferry service may be appropriate in other areas of the Vancouver-Portland region.

4.2.3 TR-9 Monorail System

Description:

Monorails are guided transit vehicles operating on or suspended from a single rail, beam, or tube. The monorail systems most familiar to Americans are located in downtown Seattle, Washington and at the Disneyworld and Disneyland theme parks in Orlando, Florida and Anaheim, California. Monorail cars themselves are rubber-tired and straddle a single, narrow, elevated beam that is approximately 25 feet above the ground. The cars are self-propelled by electric motors and are usually coupled together in trains of two to six cars. Because it straddles a single beam, monorail requires a much more complicated vehicle support system than rail vehicles. Thus, a monorail vehicle has 24 rubber tires as compared to a rail vehicle's eight steel wheels. The much higher resistance of rubber tires than steel wheels results in greater energy consumption and heat production. Moreover, monorails have less riding comfort and their interiors are less spacious than rail vehicles.

Historically, most monorail systems were built and operated as one-way loops. Modern monorail systems now incorporate new track switching technology that lets them operate like most modern rail systems. Several cities in the United States have considered monorails, namely Seattle, Washington (an extension of the existing system); Las Vegas, Nevada; Jacksonville, Florida; and others. Due to cost overruns, the Seattle monorail project was recently terminated.

The capital cost for constructing monorail systems is between $50 million and $200 million per mile, and most of this cost is for elevated guideway construction. **Figure 4-9** shows a typical monorail train.

Figure 4-9. Monorail

Rationale for Not Advancing:

Monorail service fails Step A Question #2. Monorail systems are most commonly used in specialty niche applications for very local circulation, and have never been used as a regional transit system in North America. Monorails typically have been built only for special purposes, such as amusement parks and airports, where elevated structures are not likely to be opposed by numerous private residences and businesses. Only a few cities, mostly in Japan, have built monorail as a general purpose transit line. In fact, there is no city with more than one monorail line anywhere in the world. It is generally accepted within the transit industry that light-rail and heavy-rail are more efficient and appropriate for high-quality urban mass transportation than monorails.

A monorail service could conceivably be designed to serve multiple destinations within the Bridge Influence Area and I-5 corridor, since the technology is not uniquely suited to long-distance or short-distance travel. In order to improve existing transit service in the Bridge Influence Area, however, it would have to be integrated with the existing bus and rail network, which is infeasible; the technology would require a completely grade separated right-of-way. For these reasons, monorail is not an appropriate public transportation component for the Bridge Influence Area.

4.2.4 TR-10 Magnetic Levitation Railway

Description:

A magnetic levitation (Maglev) railway is a high-technology rail system that operates on a specially-designed exclusive right-of-way and exceeds speeds of 200 miles per hour. The ideal trip distance for Maglev technology is between 50 and 500 miles. Maglev vehicles are propelled along a fixed guideway at high speeds by the attraction and repulsion of magnets on the rails and under the rail cars. Thus Maglev cannot share existing infrastructure and must be designed as a completely separate system. The capital costs of constructing a new Maglev railway are based on estimates of $100 million to more than $200 million per mile, depending on location and specific engineering required by the site. **Figure 4-10** shows a typical Maglev railway.

Figure 4-10. Maglev Railway

Rationale for Not Advancing:

Maglev fails Step A Questions #1 and #2. Given its travel speeds and acceleration characteristics, Maglev railways cannot adequately serve closely-spaced transit markets (e.g., downtown Vancouver and Hayden Island). Local Maglev rail service would likely have very few stops or stations, and perhaps no stops within the Bridge Influence Area, and thus would not serve the identified transit markets. In a hypothetical application, such a system would likely only have one stop in Salem, one stop in Portland/Vancouver, and one stop in Seattle, for instance.

To improve existing transit service in the Bridge Influence Area, it would have to be integrated with the existing bus and rail network, which is infeasible; the technology would require a completely grade separated right-of-way within the Bridge Influence Area and beyond.

Maglev railways are specifically designed for long distance trips. There are no operating Maglev railways in North America, and it is highly unlikely that the technology would be implemented without a prior federal, state, and local commitment. For these reasons, Maglev railways are not an appropriate public transportation component for the Bridge Influence Area.

4.2.5 TR-11 Commuter Rail Transit in BNSF Trackage

Description:

Commuter rail service is typically used for long distance travel between a central city, adjacent suburban areas, and other cities within a region. Commuter rail systems typically use diesel-powered locomotives and passenger rail cars and operate in existing railroad rights-of-way. Service is provided during morning and evening peak commuting periods. Large urban areas of North America, with population sizes ranging from two million to over 10 million people, use commuter rail for transporting people from outlying suburbs to the central city. On a per mile basis, commuter rail typically costs between $5 and $25 million per mile. Commuter rail is often less expensive than other rail modes because it typically operates on existing railroad rights-of-way and shares trackage with freight operations. Since commuter rail typically operates in freight rail corridors, there are usually extensive negotiations with the active railroad for the privilege of sharing the right-of-way and an annual trackage fee is paid. **Figure 4-11** shows a typical commuter rail train.

Figure 4-11. Commuter Rail Train

Rationale for Not Advancing:

Commuter rail operating on existing regional freight rail trackage fails Step A Question #2. To improve existing transit service in the Bridge Influence Area, it would have to be integrated with the existing bus and rail network, which is infeasible, as the technology would operate in a completely grade separated right-of-way.

In addition, during the I-5 Partnership Study, an in-depth study of commuter rail options determined that due to projected congestion in the existing freight rail system in the next 20 years, commuter rail could only be implemented on a separate passenger rail-only network; it could not be implemented on existing regional freight rail trackage. Some of the key findings from this study include:

- 63 freight trains and 10 Amtrak trains cross the Columbia River on the Burlington Northern Santa Fe (BNSF) bridge now; in 20 years this is projected to grow to 90 freight trains and up to 26 passenger trains.
- Existing train speeds are very slow (12 to 15 mph) and about half of normal operating speeds. The delay ratio (delay hours/train running hours) is 33 percent; 15 to 20 percent is considered to be normal. As the delay ratio grows, commuter rail service degrades until it is no longer viable.
- Slow speeds and train “bunching” are due to track constraints (which are constrained by the built urban environment), topography, and limited bridge crossings. In addition, the large number of local and yard trains needed to serve area industries would also congest the mainline.
- Due to mainline congestion and bunching, there is poor recoverability if breakdowns occur anywhere on the network.
- The narrow rail corridor through the region restricts improvement alternatives (e.g., passing tracks, parallel routes).

While new commuter rail service along regional freight rail trackage could conceivably serve some transit markets in the Bridge Influence Area (e.g., North Portland), it would provide poor, out-of-direction service to some key activity centers (e.g., downtown Portland). That said, it is not feasible to implement this service on the existing rail network.

4.2.6 TR-12 Heavy Rail Transit

Description:

Heavy rail is a moderate-speed, passenger rail service operating on fixed rails in exclusive rights-of-way from which all other vehicular/pedestrian traffic is excluded (also known as rapid rail; subway; or metro). Heavy rail generally uses longer train sets and has longer station spacing than light rail. Most heavy rail systems have at least part of their trackway underground. Heavy rail systems are used in large metropolitan areas ranging from three to over 15 million people. Examples include San Francisco's BART system and the subway systems of New York and Washington, D.C. The capital costs of constructing a new rapid rail system can range from $100 million to more than $200 million per mile, depending on the location and specific engineering required by the site.

Similar to light rail, heavy rail is a proven technology that serves regional trips. One of the main differences between heavy rail and light rail is that heavy rail typically requires a completely grade separated right-of-way while light rail can operate in mixed right-of-way environments. Another key difference is that light rail trains can serve between 5,000 to 12,000 people per hour in the peak direction, while heavy rail trains can accommodate between 15,000 to 60,000 people per hour in the peak direction. Heavy rail is typically considered to be a logical option when passenger demand far exceeds the person carrying capacity of either buses or light rail. The requirement of grade-separated right-of-way and the benefit of extra passenger carrying capacity are the main differences between heavy rail and light rail. **Figure 4-12** shows a heavy rail train.

Figure 4-12. BART Heavy Rail Train

Rationale for Not Advancing:

Heavy rail fails Step A Question #2. To improve existing transit service in the Bridge Influence Area, it would have to be integrated with the existing bus and rail network, which is infeasible, as the technology would operate in a completely grade separated right-of-way.

Regarding the identified transit markets, new heavy rail service could conceivably serve some of the significant transit markets in the Bridge Influence Area and beyond (e.g., downtown Vancouver, North Portland, downtown Portland). However, heavy rail becomes cost effective only when there are large peak hour passenger demands, such as those seen in the world's largest and most congested cities: New York, Washington D.C., London, Tokyo, etc. There are no heavy rail lines in the Portland-Vancouver metropolitan area, and no regional plans to consider heavy rail.

For these reasons, heavy rail is not an appropriate public transportation component for the Bridge Influence Area.