Busways or LRT ? - Why Portland chose Light Rail.

Some Context.

In the early 1970's Portland, Oregon's transportation policies experienced a period of turmoil. A recently approved plan to build a regional network of freeways and expressways floundered as the costs and impacts began to be understood. The idea that transit, (represented at that time by a failing private bus company,) could be part of the solution had little credibility. Oregon's Governor, Tom McCall appointed a task force of prominent citizens to recommend a way out of the policy deadlock. The Governor's Task Force reported back that it was not practical to build enough roads to satisfy the demand for unrestricted highway use, and that attempting to do so would place an immense burden on public finances, and cause major negative impacts to the community and city environment. The Task Force recommended that future investment in the highway system be constrained to completing projects already under construction, correcting safety problems, and balancing segment capacity throughout the highway system. A network of bus or rail transitways was proposed to augment the capacity of the highway system, and to provide a high quality alternative mode of travel.

30 years later, Portland has built 4 light rail corridors, with a fifth nearing completion. 105 rail cars and 635 buses attract over 300,000 boarding trips per day. No major new highways have been built for 25 years, and despite population growth, Portland's traffic congestion is no worse than that in comparable cities that had invested heavily in urban highways.

A hundred years ago, the streetcar was the dominant mode of urban transportation. Around the world, many hundreds of cities invested in streetcar systems. But between 1920 and 1960 automotive technology advanced rapidly, and private cars and buses replaced the streetcar systems in most urban areas. Then, under the burden of congestion, and traffic impacts, planners began to consider light rail again, as an ingredient in the urban mobility mix. By 2008, numerous new light rail systems had been built, and more were being proposed somewhere in the world at the rate of about one a week. Portland was a pioneer in this movement, but its experiences are typical of many other cities today.

In the 1970's, when LRT was first proposed in Portland, it was less than 20 years since the last streetcar had run. "Why ?" people would ask, "bring back streetcars, if they didn't make sense before ?" But at the time of their demise, the old streetcars and their tracks were worn out. Highways were the growth industry, and most cities had neither funding to improve public transit, nor appreciation of the short-comings of relying only on highways. Transit operators generally perceived that if you had a vehicle the size of a bus, and you ran it in the street, like a bus, it was a lot cheaper to run a bus. And so buses became the main mode of urban transit, and by 1960, streetcars were virtually extinct.

While the economic argument against streetcars was more or less valid everywhere, some European cities came up with a different solution. They did not scrap their streetcars. Instead, streetcars became bigger, often two or three times the size of buses. They could

be coupled into trains, with a single driver. Fare collection was reformed, to allow boarding from the street through multiple doors, and traffic priority was introduced. New railcars, and new tracks led to greater comfort and quieter operation. The result was quiet efficiency, comfort, and public acclaim. This is the essence of modern light rail.

In the U.S., transit planning in the 1970's generally recognized only two modes; buses, and heavy rail (ie subways). In Portland, the 1973 "Transit Master Plan" for 1990 called for a fleet of 1000 buses, operating on streets and a network of busways. Light rail was not considered relevant. The Governor's Task Force also recommended bus transitways, but suggested that in some corridors, where railroads existed, light rail might be a feasible alternative. In 1977, detailed studies began for the region's first transitway corridor. Initially proposed as a busway, these studies eventually led to the adoption of light rail as the preferred alternative.

Portland's first light rail line opened in 1986, and in subsequent years and in new corridors, the initial decision to adopt LRT has been revisited and tested repeatedly against other options, particularly bus alternatives, under the critical eye of the Federal Transit Administration. And in each corridor, LRT has emerged as the preferred alternative. This is not to deny the role buses play in the regional transit system. Two thirds of the region's transit ridership is still on the bus system, and there are now 10 urban bus routes where the introduction of frequent all-day service has resulted in spectacular ridership increases.

The purpose of this paper is to outline some of the reasons why the Portland Region adopted light rail initially, and has been expanding the network ever since. While other cities may have different conditions or priorities, many of these reasons can be adapted to local conditions, and are, in general, widely applicable.

LRT is efficient.

There are many aspects to efficiency both in operating costs, and the use of street space. Consider:

- In Portland, each railcar does the work of at least 4 buses. Carrying over 200 passengers, each car has over 3 times the capacity of a bus. It also moves about 25 % faster through traffic due to faster loading and traffic priority (see more below). And the rail cars usually operate in two car trains, so that each train does the work of 8 buses, still operated by one driver.
- An LRT train, coming every 8 minutes, can reasonably expect to get signal priority at intersections. The equivalent buses would come every minute, rendering signal priority impractical.
- LRT moves people far more efficiently through the streets. A train moves as a unit, passing through an intersection in about 12 seconds. The equivalent buses behave like a concertina. The first bus goes through the intersection. The second bus starts up, and follows it, and so on, stretching the buses out like a concertina. The fifth or sixth bus will miss the signal, and have to wait for the next green light. And in doing so, will delay buses following on the next signal cycle.

- Much the same thing happens at stops. A train pulls up, and people get off and on through multiple doors. A Portland train has 8 double-wide doors. When a group of buses pull up, the passengers run back and forth at the stop to see which bus they want to board, creating confusion and delay. In busy times, bus dwell times can be twice LRT dwell times.
- Although a rail car costs far more than a bus, its greater capacity, and longer life result in very similar life cycle costs. A railcar typically lasts twice as long as a bus. For instance, TriMet retires its buses after 13 to 15 years, while the first batch of railcars are still in daily service after 23 years. In 2008, a railcar cost about $4,000,000. A bus cost about $300,000. If the railcar can do the work of 4 buses, it would replace about $1,200,000 worth of buses. But after about 14 years, these buses would need to be replaced by four new ones. And with 14 years of inflation, these will cost almost twice as much, say $500,000 each, or $2,000,000 total. So the $4,000,000 railcar saved $3,200,000 worth of bus purchases over its 30 year life. And this doesn't consider the operating cost savings.

Given a choice, the public prefers trains to buses

The Governor's Task Force had designated a busway as the preferred mode for Portland's first transitway, with the State Highway Division as the lead agency. However as the study progressed, the community began to advocate for a rail alternative, a position supported by technical analysis. Eventually light rail was selected as the preferred alternative; a fairly daring commitment in 1977. Public preference for rail is frequently encountered in the transportation field, particularly where the public is already familiar with a modern rail system. This preference is difficult to account for using only the common measures for performance and cost, suggesting other factors need to be considered:

- Recent surveys in Portland have shown support for the rail system approaching 80%. The eventual expansion of the rail system to all the major transportation corridors has become the foundation of the region's transportation policies.
- One suburban community had initially objected to having rail "forced on them" by the regional planning process. Defeated at the polls, the rail project was cancelled, and alternative (bus oriented) transit plans presented to the community. After 2 years of studying all the non-rail options, the community decided they preferred light rail after all.
- It is difficult to pinpoint the rationale for public preference for rail. It is probably the cumulative effect of many small advantages, such as better waiting conditions (vs bus stops); smoother, faster, quieter ride; reliability; easier "way-finding", and the confidence the user derives from a fixed facility.
- And this "implied" public preference translates into "observed" ridership increases. After years of measuring and analyzing the performance of new LRT lines, the Portland region has been able to convince the Federal Transportation Administration (who monitors and approves the planning of all projects it helps fund) that there really is a rail bias factor, and that it can be legitimately used in projecting future rail ridership. The numerical value of this "rail factor" is a function of corridor characteristics, and varies from project to project.

- Observation of rider patterns shows that passengers sometimes walk several blocks past a parallel bus route to reach a rail station that serves the same destination.
- Advertisements for homes and apartments often mention their proximity to the rail system. Studies of property values consistently show increases attributed to the proximity of rail stations.

Rail helps structure/restructure the community

Rail is often perceived as giving structure to a city; creating a sense of "place". Historically, streetcar lines were often promoted by real estate developers. The new generation of rail lines are often seen as the catalyst for urban regeneration. Here, bus "flexibility" is not necessarily an asset. Rail creates the permanent framework needed to support development and investment decisions. Consider:

- Attracted by redevelopment, and under pressure of rising fuel costs and traffic congestion, population is returning to the central city. In Portland, the City streetcar has been influential in attracting a new wave of urban dwellers who make little or no use of their cars in their daily round
- Since rail re-appeared in the region, in the 1980's, it has become a dominant consideration in the location of major new public and private facilities. Access to rail reduces the traffic impacts of such developments, and leads to further increases in transit ridership.
- Although buses are more "flexible", the main corridors in an urban area do not change, and their permanence is fundamental to many development decisions.
- A particularly unfortunate fiction is the concept of the "convertible busway", often touted to disarm rail protagonists. Advocates of convertible busways suggest that a busway, once it had built up ridership, could be shut down (for a year or two,) dismantled and rebuilt as a rail line. Thus one type of transitway (buses) would be replaced with another, rather more effective mode (rail), at immense additional cost. Overlooked is the disruption riders would experience during the changeover, and the wasted investment such a plan implies. Meanwhile adjacent properties would endure a double dose of construction impacts and traffic disruption, and the land use benefits often attributed to rail would be deferred. Not surprisingly, while convertible busways have been proposed frequently, and they have seldom been built.

Rail is the greenest option

Greenhouse gases, pollution, peak oil, sustainability and changing urban lifestyles are changing the world. Rail has become a key element in the drive to reduce greenhouse gases. Consider:

- Large concentrations of buses create significant noise and air pollution, degrading the street environment and the riders travel experience.
- In the 1970's Portland concentrated its growing bus system on two transit mall streets downtown. Passengers enjoyed improved waiting amenities, and more convenient transfers. It also underlined the environmental consequences of relying on buses alone as the number of riders and buses grew. Introducing rail

has capped the increase in bus numbers and impacts downtown, even as ridership has increased dramatically.

- Rail has demonstrated a dramatic influence on land use and development decisions. Most of the major public facilities built in recent years (Convention Center, Sports Arena, government offices etc) have been located within walking distance of a rail line. In addition, most of the region's high density development has been attracted to the vicinity of rail stations. Consequently even more rail ridership is attracted over time, and these facilities generate far less traffic than if they were sited randomly, not on the rail system.
- LRT uses electrical power, which is quieter, particularly when accelerating, produces no pollution in the streets and is derived from a variety of sources, many of them (wind, hydro, solar) renewable.

Rail is a proven technology.

In the early days of the transit revival, transit planners were confronted by a profusion of new transit modes that were allegedly able to solve the shortcomings of the existing bus and rail systems. There were monorails, personal rapid transit, a variety of guided buses, maglev, and a several proprietary automated systems. These systems had several common characteristics. They were new and untested, and the claims of their proponents could not be substantiated. Typically they were proprietary technologies resulting in the customer being tied to the original supplier. (who might, and often did, go out of business). Of the few "new mode" systems built, almost none were built twice, and some have even been abandoned, or languish on as "transit orphans".

A particular problem with guided buses is the difficulty of providing a fail-safe signal system to allow vehicles to travel fast and safely when sight distance is limited by curves, tunnels, or the weather. This problem has lead to several busway accidents.

By contrast, rail, and particularly light rail is a long established technology. It is a package of well-proven components that can be configured to suit a variety of conditions without technical risk. All of the components (track, signaling and vehicles) are available from multiple, competing suppliers, and life expectancy and long term performance can be confidently predicted.

Conclusion

This brief paper summarizes some of the reasons why, 30 years ago, Portland decided to build a new light rail system, and has continued to expand that system to this day. It has often been alleged that many of the individual attributes of rail can also be achieved with buses, at a lower initial cost. Buses can be electrified. Longer buses can be built, and even provided with trailer buses (subject to traffic regulations). Several concepts for guiding buses have been developed, and busways as permanent as a rail line have been built. But a system that wants all of these attributes will invariably find that it is more cost effective, and carries less technical risk, to do so with a rail system. A conclusion one can observe today on transit systems all over the world.

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