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The Rail Transit Debate

*An Assessment of the
Arguments*

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Introduction and Summary

The selections of a transit mode - specifically, bus or rail - might seem to be a technical matter. Yet, for the last two decades, this policy choice has given rise to an intense debate driven by a remarkable degree of passion on both sides. Frequently, rational arguments based on data and other objective criteria are clouded as disputants exchange charges of hidden agendas, special interest motivation, zealotry and wrong-headedness.

In a number of cities located in eastern, central and western North America, an urban passenger rail system - typically surface "light rail" - has solidly established itself as an amenity. In these cities, support is strong for rail transit as a travel alternative and in some cases as a magnet for development. The successful performance and the degree of public approval these systems enjoy belie the notion that rail transit is a fatally flawed approach that cannot be made cost-effective.

At the same time, critics have their own strong point. The monetary price for constructing a rail transit system is large - so large it carries an opportunity cost - the "price" of pre-empting financial resources that could have been used to do something else. Thus, the foes of rail have done a perhaps-unexpected favor for proponents of rail, forcing them to sharpen not only their arguments but also the specifics of their plans, in order to gain the greatest benefit from investing in rail transit.

No critique of rail transit has been more influential than that of Emory Bundy. He has effectively marshaled the anti-rail case in a way that has had significant impact. The analysis below begins with "The Bundy Indictment," drawing together his arguments against rail in a condensed format. This is followed by "Other Voices in the Debate," offering different perspectives, many of which prove favorable to rail.

On many points, a complete synthesis or reconciliation of views among opponents and

proponents in the rail transit debate is not possible due to an unbridgeable divergence of claims and conclusions. Both Bundy's position and that of other voices in the debate are presented below in the form the participants have put them forth. It is beyond the scope of this paper to perform primary research that would be needed to confirm the validity of positions that have been taken by each side on several issues. However, a summary of the weight of arguments that have been offered on each point can be attempted, as follows:

Transit-oriented development

Rail transit can support desired land-use outcomes - if land use policy supports rail. LRT foes charge rail cannot recreate the 19th century city. LRT advocates do not seem to have this as a goal. Rather, they aim for nodes of rail-oriented development that add a lifestyle option, even within cities that may remain largely auto-dependent. Rail supporters also note this mode is unsurpassed in serving the highest density areas, which can help achieve compact urban form and open space preservation.

Energy consumption and air quality impacts

While there is no dispute that transportation is the largest contributor to CO₂ and CO emissions, and a major factor in Nox and NMHC emissions, there is wide variation among estimates of pollution by vehicle type per passenger-mile. The crucial factor in this variance is probably the assumed average occupancy of bus and rail transit vehicles.

However, advocates of transit (rail in particular) note that the issue goes beyond fuel use per passenger-mile. Since high-capacity transit supports high density, it creates "transit leverage" - the ability to reduce miles traveled per day by the average resident. This compounds the saving in fuel and reduction of air pollution.

Construction costs

Critics argue that building light rail systems is expensive, especially relative to ridership. Defenders respond that rail construction costs cannot be viewed in isolation. Instead, comparisons should be made between incremental costs of adding capacity in each mode; especially capacity that maintains access and mobility standards in peak-hour use.

Rail supporters also argue that surface rail projects have been no more prone to construction cost overruns than other types of transportation infrastructure. Major cost penalties are imposed on rail projects when the route leaves the surface and tunneling is required, and major cost savings per mile of construction are achieved when right-of-way (and, even better, trackage) is available.

Operating costs: bus versus rail

The ability of rail transit to link multiple cars in one train set with a single operator is claimed as an operating advantage of rail due to lower labor costs per passenger-mile. Critics charge that the level of operating subsidies for rail does not square with this assumption. As with pollution, a crucial assumption is the average ridership in transit vehicles.

Research suggests that overall cost per passenger mile is relatively similar for auto, bus and rail. Each mode is heavily subsidized. An estimated 85% of the auto subsidy is in the form of social costs that are not explicit, while a similar share of rail costs are from highly visible forms of public support.

Comprehensive cost-benefit analysis

Auto use is analytically vulnerable on the basis that it has been subsidized for decades, with many costs “externalized” in the form of penalties on public health, environmental quality, and time lost in congestion. Rail supporters defend subsidies as creating a level playing field in a

way that is direct and open. One counter argument among opponents is the unaccounted cost of free park-and-ride lots for transit.

Impact of rail on total transit ridership

Opponents charge that new rail transit systems degrade bus service and are associated with a decline in total transit use. This claim does not seem to be borne out in the majority of examples. Light rail appears compatible with a growth in total transit ridership and is able to attract a portion of auto commuters who will not travel by bus.

Also, in large metro areas with severe congestion, bus-only transit reaches capacity limits due to conflict with auto traffic on routes that have no dedicated transit right-of-way. A balance of bus and rail is suggested in these cases, while noting that - as in the case of Seattle’s downtown transit tunnel - rail use of facilities should not be preemptive in ways that harm bus service. Ultimately, however, many transportation analysts conclude that bus-rail conflicts are of less importance than the opportunity to optimize the benefits of transit by utilizing the strengths of each mode - for example, rail’s high capacity relative to footprint, and the route flexibility of buses.

Impact of rail on transit service in lower-income communities

The Los Angeles case is a striking example of a cost conflict between suburban rail service and inner city bus service. Rail foes rightly point to this as a caution that cannot be dismissed. Even where bus and rail services come from separate agency budgets, it is regional political will and total funding capacity that is at issue.

This said, it is also true that an extensive rail system - once in place - can support employment opportunities for inner-city residents throughout the metro area, providing the jobs equivalent of “moving to opportunity.” Obviously, achieving such a benefit depends on the

specific service routes of rail plus avoiding direct funding conflicts of the kind faced in Los Angeles.

Relevant measures of market share

Rail cannot compete in serving America's increasingly complex vehicle trip patterns. Where rail shines is in moving people to and from major centers of employment, shopping and entertainment; in particular, transporting workers with jobs in central business districts. High-density development in CBD's provides a concentration of destinations that makes location of more roadway capacity either impossible or expensive. As opponents note, rail's share of total trips in a metro area will always be low but rail's share of CBD trips can be much higher, and CBD conditions can make rail a competitive investment.

Speed, safety and reliability

Transit does not have to go faster than cars to attract ridership, but the differential between modes must be modest if transit is to be competitive. More important than speed per se, however, is reliability: on-schedule departures, on-time arrivals, and frequency of service. This, together with safety in both transit stations and on transit vehicles, provides the degree of certainty required for people to leave their private vehicles for public transit. Rail would seem to have an advantage over bus in this regard due to predictable speeds on dedicated right-of-way, higher design quality of transit vehicles, and the limited number of transfers on a fixed route.

The Bundy Indictment

Bundy bases his case against rail transit on the several elements. Each of these is captioned below, followed by a reference to counter-arguments from others voices. Then, Bundy's position is presented on each point.

• ***Development patterns.*** (For "other voices," see "Transit-oriented development," pages 11-14). Bundy argues there is a "fundamental interplay" between the dominant mode of personal and commercial transport, and the configuration of urban development. As a result of this interplay, only a fraction of urban travel in each era will employ other than the dominant mode.

In the 19th century, this mode was rail and the result was "an admirable and rather efficient system, shaped and confined by the technology of the era." The arrival of motor vehicles "changed everything" because of the unparalleled flexibility they offered people in time and space: the location of home, work and other destinations, and the timing of trips among these points. Lifestyle shifts in recent decades - more two wage-earner households plus multiple shopping, recreational and workplace locations - have strengthened the interaction between the fact of "auto mobility" and the reliance upon it.

• ***Limitations of "transit-oriented development."*** (For "other voices," see "Transit-oriented development," pages 11-14). Bundy concludes that rail, as a fixed system, cannot shape development patterns to resemble the rail era at a time when motor vehicles are the dominant mode of transport.

As a result, hopes that the direct cost of rail will be overcome or even offset by transit-oriented development (TOD) are misplaced. The shops, services, and high-density housing projects that have been developed around transit stops typically have a history of "high perpetual subsidies" on top of "enormous capital investments" for the rail system itself.

Bundy says rail proponents have presented an idealized picture of attractive, mixed-use, pedestrian-friendly urban environments. This vision is "disingenuously hijacked" into the service of an inflexible system based on outdated technology whose "ruinously expensive" operating expense imposes punitive "opportunity costs" that foreclose better alternatives by exhausting

community financial resources. The result is to undercut the very vision of urban livability that advocates claim can only be served by rail.

• ***Environmental impact.*** (For “other voices,” see “Energy consumption and air quality impacts,” pages 14-15). The failure of transit-oriented development as a land-use tool is aggravated by an unexpected problem: fuel consumption. The U.S. Department of Energy estimates that BTUs per passenger-mile are 3,593 for autos, 3,687 for rail and 4,374 for buses. Moreover, the least energy-efficient bus lines are typically feeder lines that serve rail.

• ***Intractably high cost.*** (For “other voices,” see “Actual versus estimated construction costs,” pages 15-17). Rail’s greatest weakness is its inflexibility relative to people’s trip patterns and choices. This weakness is compounded by high cost per mile of route, which inhibits the ability to build a rail system serving more than a small fraction of destinations. The problem of connecting trip points of origin is even greater.

Initial costs are high relative to capacity, and completion of construction does not mean a stabilization of costs. Boston, for example, integrated its rail and bus system and extended rail lines. Yet, despite fare reductions and area population growth, ridership remained static. Meanwhile, the annual subsidy swelled from \$21 million in 1965 to \$575 million in 1991. Even this level of subsidy does not fully amortize capital costs.

• ***Low capacity relative to cost.*** (For “other voices,” see “Operating costs: bus versus rail,” pages 17-18, “Comprehensive cost-benefit analysis,” pages 18-19, and “Relevant measures of market share,” pages 24-27). Bundy chides rail transit promoters for claiming “One light rail line will supplant 12 lanes of freeway.” He counters that a single general-purpose lane on any urban freeway carries more people than any light rail line in America.

Nor does the use of facilities for rail score well compared to buses. Bundy notes that the proposed conversion of a tunnel in downtown Seattle from bus to rail service would result in a 25% loss of peak-hour seat capacity.

Bundy observes that if Seattle’s proposed light rail system meets the target of 37,000 “new riders” on its trains by 2010, this translates into a cost of about \$175,000 per auto removed from the daily commute. He says ways can be found to reduce personal auto use at far less cost and far more quickly (see “Alternatives” below).

• ***No net gain in transit use.*** (For “other voices,” see “Impact of rail on total transit ridership,” pages 19-22 and “Speed, safety and reliability,” pages 26-27). Adding rail as a transit option has failed in every case to stem a precipitous decline in the use of transit and a surge in auto use. Even in the few cases where total transit ridership rises with rail, transit’s share of metro travel continues to decline. In the thirteen U.S. metro areas that introduced or expanded rail service in the 1980s, the uniform result was a decrease in transit market-share and a sharp increase in subsidy requirements.

The problem is especially daunting in metro regions with strong population growth. In Seattle, for example, the 37,000 new riders are actually 18,500 persons making two-way trips. This equals six-tenths of one percent of the region’s population and is one-thirtieth of estimated growth, which will exceed 600,000 persons from the rail project’s start date to full operations in 2010.

The pattern holds even in Europe, which enjoys the competitive advantages of compact communities, costly auto fuel, and superior train service. By 1970, passenger-miles traveled by auto in the European Union were already 50% higher than the combination of rail, buses and motor coaches. By 1996, auto miles had risen 250% while transit miles in all modes were static and had fallen to a one-fourth-market share.

• ***Diversion of resources.*** (For “other voices,” see “Impact of rail on transit service in lower-income communities,” pages 23-24). Bundy argues that the biggest losers from investments in metro rail systems are metro bus systems. Bus service is cut and fares are raised to pay for rail. The combination of fewer routes, less frequent service and higher prices leads to fewer bus riders. The cost impact is aggravated when bus routes are reconfigured to serve as “feeders” for new rail systems.

The burden of a less adequate and affordable bus system falls disproportionately on lower-income persons including minorities, students, and the elderly. In a Los Angeles case, the NAACP Legal Defense Fund won a court order telling the transit agency to put dozens of buses back into service, restore routes and frequency, and reduce fares.

The suit charged that about 15% of transit patrons with average incomes of \$65,000 used rail, which received 45% of the transit subsidy. By contrast, the other 85% of transit patrons with average incomes of \$15,000 rode buses, which received 55% of the subsidy. On a per-ride basis, the subsidy for rail was five times that for the bus system.

Preconditions for a Sensible Rail System

Bundy’s indictment of passenger rail is not absolute. It recognizes factors that can alter the equation to bring a metro rail system within a reasonable cost-benefit ratio.

• ***Availability of existing corridors.*** The most important factor making commuter rail a viable option is availability of one or more existing corridors that offer rights-of-way and serve routes with reasonable ridership potential. These routes have even more potential to pencil out if rail tracks are in place.

Bundy cites San Diego’s south system built at \$11 million per mile and Chicago’s

METRA suburban commuter system as examples of investments that worked. “While these projects are hardly a panacea for urban congestion, they are sensible additions to the transportation mix of their communities,” Bundy concludes.

• ***Inter-city routes that are ridership-rich.*** Several corridors exist where rail can serve as an attractive, competitive inter-city travel option. These corridors are congested and have numerous population centers within compact distances. Thus, rail is a sensible alternative to both auto and air travel on intensely used inter-city corridors. Typically, carriers such as Amtrak operate profitably on such routes, indicating they are cost-competitive.

Congestion-Relief Alternatives to Rail

Bundy argues that the goal of reducing auto commute trips can be pursued through a wide range of tools that are far quicker and less costly than rail in relieving metro area congestion. These tools are based on two kinds of economic signals: setting prices to reflect real costs, and offering incentives for actions that reduce or avoid costs.

• ***True-cost pricing.*** “Auto mobility” is heavily subsidized by shifting many costs of auto use - “land alienation” from roadways, environmental pollution, human health and safety impacts, urban wastewater runoffs - so they are paid for through taxes, other consumer expenses, and quality of life impacts.

In his own summaries, Bundy puts true-cost pricing last on the list because “it is probably the least viable politically.” But it also makes sense to start here because this is a cross-cutting concept. An economic law states the logic: When any good is under-priced, it will be over-used.

Bundy says that so long as freeways are free, they are destined to be used inefficiently. Drivers and taxpayers pay a tax in congestion and construction costs; they just don’t pay by

the trip. Bundy cites an AAAS-Aspen Institute study, "Avoiding the Collision of Cities and Cars," which concludes, "As people began to pay the full social costs of driving, they would take greater care in deciding when and how to move from place to place. Solo travel would decrease... in favor of shared mobility."

- **Value pricing.** Also known as "congestion pricing," value pricing has long been used to moderate peak-hour demand for electrical power, telephone use, transit and air travel. By sending a price signal, it shifts a portion of the load to lower-demand periods when capacity is not maximized. This prolongs the adequacy of existing infrastructure and thus defers major capital costs.

Technology now makes it possible to charge fees without using toll booths. Electronic "transponders" on cars can record the time of entry onto toll roads and can vary the charge by time of day or level of congestion. The benefits include collection of system revenues directly related to use of the system, and smoothing out demand to extend the adequacy of existing capacity. Political issues to be resolved include the privacy of transponder data and the equity impacts of tolls on lower-income users.

Value pricing fits not only roadways but parking spaces. Companies go to a major expense in providing free parking for employees, Bundy notes, while doing little to encourage use of transit, carpooling or bicycling. He urges either charging auto users for company parking or rewarding other employees by paying them the true cost of parking as an incentive to use auto alternatives. Bundy also scores rail transit plans that budget large sums for free parking lots to attract train riders.

- **Economic incentives for lower-cost commuting.** A variety of measures can reward forms of commuting that impose less system cost less per trip than SOVs (single-occupancy vehicles).

- **Carpooling.** Average auto occupancy is about 1.1 persons, leaving about 80% of seats empty. This capacity represents an immense resource that today's telecom technology can help utilize. In the Seattle area, the regional council estimates that carpooling will handle 4.74 million person-trips each day by 2010. This is almost ten times the amount projected for all forms of transit, which is currently subsidized at \$600 million a year.

- **Vanpooling.** In a Seattle-area example, the metro transit agency estimated that it can garner the next increment of 5,000 vanpoolers through incentives that will cost \$2,200 per car removed from the commute mix. This is equal to only 1.25% of the \$175,000 cost per rider of building and operating proposed rail transit systems.

- **Commuter trip reduction laws.** Washington State law requires companies with more than 100 employees to apply a mix of tools - higher parking fees, subsidized bus passes, carpool and vanpool incentives - to reduce commute driving. At a public cost of \$3 million per year, or \$30 million over the decade, it has removed 18,000 cars from the commute mix - "almost exactly the number Sound Transit trains might remove for \$3 billion or so," notes Bundy.

- **High occupancy vehicle lanes (HOVs).** HOV lanes on I-5 north of Seattle, restricted to vehicles carrying two or more passengers, move 6,000 people per hour during peak travel times, versus 2,000 in general-purpose lanes. HOV lanes also move faster at rush hour, providing a time advantage that offers an incentive for travel by carpool, vanpool or bus.

- **Bicycle lanes.** Bundy, an avid bicyclist who has not owned a car since 1982, notes that "thousands" of Seattle-area commuters use this mode and adds, "Think what could be accomplished if they were facilitated and encouraged."

• **Bus rider subsidies.** The form of subsidy to bus systems that is most potent in reducing SOV auto trips is reduced ticket prices. Between 1982 and 1985, Los Angeles cut bus fares from 85 to 50 cents and enjoyed a 40% ridership gain, although it already had the second-largest number of patrons of any U.S. system.

In Seattle, Bundy estimates that similar fare reductions, even if they had only half as much impact, would remove more cars more quickly from roadways than the proposed light rail system, and without as \$3 billion capital cost.

One approach would eliminate bus fares entirely to create a large “free zone” in Seattle. A model is the University of Washington’s U-Pass program, which combines cheap, unrestricted bus passes with better bus service and higher parking fees. The program costs \$8 million a year but its net impact has been a 20% cut in auto commutes to campus, sparing UW from the cost of new parking structures.

Former Metro transit director Chuck Collins has proposed Ride Free, a plan to fill the 31% of bus seats now entering downtown empty at rush hour. The plan would waive fares in the service area, thus speeding service while eliminating the largest source of disputes between drivers and passengers. Ride Free would add 100 buses for heavily-used runs and apply 4,000 new vanpools for home-to-work service.

Bundy estimates that at a cost equal to rail transit, Ride Free would take six times more cars off the road and do it far more quickly.

• **Flexitime.** Use of flexible working hours by an estimated 40% of the workforce in Germany and Switzerland is a direct means to reduce peak demand on roadways. It has also improved worker morale. Examples can be found in the U.S. but the approach has not been applied broadly or effectively. It fits especially well in an era when many permanent jobs at major companies have been replaced by contract employment.

• **Personal transit.** Bundy says rail-system advocacy is often static in its thinking about new technology. He sees “small, on-demand transit vehicles” based on telecom networking technology and employing flexitime workers on modest-cost labor contracts. Farther in the future, he sees a host of new materials technologies and electronic guideway systems that could make door-to-door personal transit even more flexible and affordable.

• **Least-cost planning.** The most comprehensive way to encourage lower-cost approaches is to insist upon them, Bundy concludes. He cites the dramatic example of energy planning in the Northwest U.S., where the annual growth rate in regional demand was cut from 6% to 1%. Least-cost planning “is an open process in which numerous options are assessed or compared in a rigorous search for the combinations of investments that will reach the desired level of service and reliability at the most advantageous cost.”

Bundy decries the notion that somehow transportation is “more complicated” than energy, noting that each is equally affected by multiple modes, a plethora of users, and non-economic values such as the minimizing the environmental impact of physical facilities.

If the goal is mobility and congestion relief, Bundy adds that least-cost planning would suggest an approach to new highway construction similar to that proposed by transportation planner Bill Eager. In the Seattle region, Eager has identified a handful of critical, overworked stretches in the freeway system that, if addressed with carefully targeted investments, could significantly improve traffic flow. Bundy calls this approach a sensible middle ground “between excess and next-to-nothing” in highway construction.

Other Voices in the Light Rail Debate

Transit-oriented development

Rail supporters strongly believe that there is a “virtuous cycle” between urban passenger rail stations and compact development patterns. They argue that the reliable presence of a concentrated clientele will attract desirable residential, retail and entertainment projects.

Recent experience from several cities offers support for this view. Perhaps most notable is Dallas, where critics said rail would fail due to low population density.

Paul Weyrich and William Lind, in “Twelve Anti-Transit Myths: A Conservative Critique,” endorse the impact of Dallas’ regional rail system, noting that its \$860 million cost has been matched by \$800 million or more in ongoing projects.

Aaron Ostrom, formerly with Transportation Choices Coalition and now executive director of 1000 Friends of Washington, notes similar claims that have been made for light rail’s impact in Portland. Since opening in 1986, Portland’s MAX “has yielded a \$2.4 billion increase in the value of development along the 15-mile Eastside line and the 18-mile Westside line.”

Ostrom adds, “While it’s probably not accurate to attribute the entire amount to the rail system, the system is certainly a focal point for new investment.” This issue is seized upon by rail foes. For example, in Dallas, light rail critic Wendell Cox argues that most new development near DART stations is also along freeways and would probably have occurred anyway.

Such a claim appears overstated due to the design character of the most notable projects near rail stations. The August 2000 issue of “Light Rail Progress” reported on the Mockingbird Station complex in Dallas, where 200 loft-style apartments are being built in a mixed-use complex that includes a food service, retail and entertainment atrium. The platform of the DART station will extend over the tracks to connect

directly with the atrium. Across the street from DART’s parking lot, 400 luxury apartments are under construction and a supermarket is nearby.

The total project is over 500,000 square feet and has attracted the attention of other developers including Hunt Bros. Property, which is working on a 550 acre site along the DART line even farther north of downtown.

Cox argues that rail advocates exaggerate the benefit in serving central business districts and cites Dallas’ relatively high downtown vacancy rate. Rail supporters respond that Dallas’ downtown has suffered from a chronically high vacancy rate for decades, and start-up of the DART system has been associated with a decline in the rate.

A recent study by Dr. Bernard Weinstein of the Center for Economic Development and Research at the University of North Texas found that commercial properties along the entire DART line have benefited from proximity to light rail.

Average occupancies for Class A office space near rail increased from 80 in 1994 to 88.5% in 1998, while rents increased from an average \$15.60 to \$23 per square foot. Strip retailers near stations registered a 49.5% gain in occupancy and a 64.5% rise in rental rates.

To answer the charge that “it would have happened anyway,” light rail supporters must show a differential between the value of properties located near the line and those elsewhere. Numerous citations exist.

In Dallas, Weinstein places the “rail bonus” on commercial property values at 25%, with Class A and C office space and strip retail being the biggest gainers. Lewis and Williams, in “Policy Planning as Public Choice: Mass Transit in the U.S.” (1999) attribute a 2% annual increment in the value of commercial real estate to the presence of transit.

While transit includes both rail and bus, rail has the edge, says policy analyst Preston Schiller. “The close relationship between land use and transit depends on rail. In Vancouver, the SkyTrain extension is being built as rail because

developers are interested in rail stations, not bus stations.”

Residential values are also impacted. Economist Aaron Gruen, as reported in *U.S. News*, estimates that in Chicago “a home located within 500 feet to one-half mile of a suburban rail station now commands an average premium of \$36,000 over houses that aren’t within walking distance. Just moving a house 100 feet closer to a railroad station increases its value by one percent.”

DART’s most costly segment was \$122 million for a 3.25 mile tunnel built because residents in some suburbs didn’t want trains stopping anywhere near their homes. “Today, DART is being asked to alter alignments, build new stations and extend its tracks to go into upscale developments,” reported “Light Rail Progress in August 2000.

The benefits are equally clear in neighborhoods with more modest average incomes, suggests Aaron Ostrom. He cites a Seattle example: “Claims that surface light rail would have destructive impacts in Rainier Valley do not hold up under scrutiny. Community leaders insisted on a surface route to make sure transit riders experienced and did business in the Valley as trains passed through. A comparison of MLK Way as it is today with renderings of MKL reconstructed with light rail makes it clear light rail will add tremendous value to the community.”

Proponents argue that rail attracts clusters of development, which tend to raise the tax base by increasing land and property values. Weyrich and Lind conclude “light and heavy rail projects throughout North America show positive impacts on property values in proximity to rail.”

This is an important element in assessing the total cost of rail. If true, it suggests major offsets to out-of-pocket costs of a rail system, in the form of greater personal wealth and higher public revenues. It also removes the need to depreciate the value of land associated with rail systems if land values are in fact augmented by rail. By contrast, proximity to highway projects augments

the value of certain types of commercial property but depresses residential values.

Even rail enthusiasts, however, offer cautionary notes to the theme of justifying rail on the basis of its impact on development. Ironically, DART may have succeeded too well in this regard. Dallas civic leader Bill Ceverha worries that “DART needs to get back to providing public transit and focusing less on spurring real estate development, especially projects it undertakes directly.”

In a comprehensive and influential analysis, “Is Rail Transit Right for Your Community?” (1995) Hank Dittmar of the Surface Transportation Policy Project argued that the ability of rail transit and land use to interact in beneficial ways is not assured. It depends on positive answers to these questions:

- Is rail investment being pursued as part of an integrated land use and growth management plan for the region?
- Are local leaders willing to change zoning in order to direct future growth in the direction of the rail system by allowing additional density while protecting open space in areas not served by rail?
- Are communities developing station area specific plans that integrate mixed use development, including housing in the vicinity of the rail system?
- Are pedestrian and bicycle access ways part of the plan? Child-care facilities, service retail, including convenience stores?
- Are government agencies willing to commit to build facilities that serve the public and/or have substantial numbers of employees, within walking distance of rail service?

The fine-grained character of land use policies required to attain the benefits of rail is suggested in points raised by a Seattle-region transportation policy staff memo (1992):

- Rail is exponentially less cost-effective as it moves away from dense, two-way, all day travel markets close to the metro center. Yet, connecting activity centers may do little to promote growth management goals. Most people don't travel between centers but between neighborhoods and centers.
- To promote growth in Everett and Tacoma, it is probably preferable to promote housing growth within close commuting distance than to promote increasingly long distance commuting. In many suburban places, a sparse arterial network is the root cause of local congestion, pushing traffic into the major corridors to serve local circulation needs.
- Rail has the potential to promote both positive and negative changes in land use, depending on how it is designed. Large stations located near freeways and surrounded by huge park-and-ride lots will not attract pedestrian-friendly development, and may worsen traffic congestion. Less grade-separated rail options with closer station spacing may have the potential to promote development that is moderate rather than high-rise, and mixed-use, pedestrian development patterns.

The same points are made by Martin Wachs, Director, Institute of Transportation Studies, University of California (Berkeley). Writing in *Blueprint Magazine* (Sept 10, 2001), Wachs says, "Claims that transit will dramatically change land use are overstated. The truth is more

modest. To be successful, transit needs the patronage, fiscal support and operational advantages that come with better-coordinated land use, including detailed design features such as pedestrian circulation paths. If people are going to use transit, it must be closer to concentrations of jobs, shopping and housing. Density bonuses and restrictions on parking space requirements should be used whenever feasible to encourage development at transit stops."

Fred Salvucci, a senior research associate at MIT and former transportation secretary for Massachusetts, stresses the role of rail and bus transit in an urban region. "The degree to which a city creates and maintains different options defines the degree of choice it provides its residents. In a city like Boston, you can choose a car-free lifestyle in the central core, or use transit for commuting and your car for other trips, or live in the suburbs where there's more than one car per house."

Salvucci concludes there is a beneficial impact not only on consumer choice but on urban form from high-capacity transportation systems that serve intense-use areas: "Public transportation - bus and rail - is an important element in supporting density that at the same time supports open space."

Energy consumption and air quality impacts

The U.S. Environmental Protection Agency (2000) estimates air pollution by source, as shown below:

Source	CO2	NOx	SOx	CO	NMHC	TSP
Residential	9%	4%	-0-	1%	-0 -	4%
Industrial	25	14	1%	60	18%	49
Power Generation	30	17	60	1	75	27
Transportation	36	65	39	38	7	20

Seattle's transit agency claims that by using Metro buses in 2001, system riders will have saved 14 million gallons of fuel and kept 3.5 million pounds of pollutants out of the air. Todd Littman of the Victoria Transportation Policy Institute (1999) estimates that public transportation saves 156 million pounds of hydrocarbons and 156 million pounds of nitrous oxides from being released into the atmosphere of North America annually.

Alan Durning, in "The Car and the City," (NW Environmental Watch, April 1996), says transit's role in reducing air pollution is enhanced because short, cold-engine car trips pollute the most per mile. In August 2000, "Light Rail Progress" reported, "Air quality issues have convinced Sacramento area officials to expand the light rail system. The long-term plan will allocate 14% of the \$4.4 billion system capital costs to LRT although only 1% of trips will be by transit and 92% by car in 2022.

"This is because it is recognized that peak-period trips to the city's core area, while a small portion of the total, are a heavy contributor to central-city smog." During periods of cold-air, low-ceiling inversion, Sacramento has had the highest pollution levels ever recorded in California.

MIT senior research associate Fred Salvucci notes that "not enough attention has been paid to fuel economy on buses. Autos, except SUVs, have gotten better on gas mileage while buses have gotten worse due to air conditioning." Salvucci says buses in a dual-mode system (electric and diesel powered) can work well to minimize air pollution. The potential will be greater in the future when much cleaner diesel fuel and eventually fuel cell technology is available.

Salvucci also notes that "in a transit-oriented city, it's not just fuel consumption per passenger-mile, it's that fewer miles are traveled. Trip distances are shorter and people can walk." Thus, transit impacts in reducing air pollution arise not just from fuel use per mile but from supporting a more compact urban form.

Construction costs

Bundy argues that constructing light rail systems costs too much, especially relative to ridership. Rail supporters seldom address this issue directly and have tended to focus instead on the question, "How vulnerable are rail projects to cost overruns?"

"Light Rail Progress" (July 2001) cites the August 1999 GAO report, "Mass Transit - status of New Starts Transit Projects with Full-funding Grant Agreements." The report reviewed 14 projects - four rail rapid transit (RRT), one regional passenger rail (RPR), two bus rapid transit (BRT) and seven light rail transit (LRT).

Among the projects, cost overruns were reported on none of the LRTs, three of the four RRTs (the exception was Los Angeles' Red Line extension), two of the BRTs and the one RPR. Of the three projects with 25% cost overruns, one was a BRT and two were RRTs.

The report singled out Boston's South Piers Transitway BRT project for detailed review. Its 27.8% overrun was the highest among the 14 projects. The factors in its actual and potential cost overruns included design problems (upgrades), utility relocation costs, vehicle maintenance facility costs, vehicle cost overruns (new bus designs) and land acquisition costs.

The conclusion by "Light Rail Progress" was that "rubber-tire mass transit has about the same propensity of cost overruns as major rail transit projects."

Loren Martens and Kelly Nordini of Denver's Transit Alliance studied "Light Rail Ridership and Cost in Seven Western Cities" (July 2001). Their findings are summarized in the table on the next page. Service area population is shown in millions, daily riders in thousands, and construction costs in millions of dollars. Most projects were slightly over budget and the only serious cost over-run was in San Jose. Ridership exceeded projections in every case.

	Dallas	Denver	St. Louis	San Diego	San Jose	Portland	Salt Lake
Metro pop. served by rail	2.0	2.2	2.6	2.7	1.6	1.3	1.7
Miles of line	20	14	34	45	21	33	15
Avg. daily riders	38.1	29.4	43.8	82.6	31.8	71.1	20.0
Capital costs	855	278	694	555	828	946	N.A.
Projected costs	830	277	689	414	505	N.A.	N.A.

Rail advocates agree with Bundy that a powerful factor holding down rail construction costs is the presence of existing right-of-way (ROW) or even better, ROW plus in-place track-age.

Baltimore's LRT had a 1992 cost of \$360 million for initial route of 22.5 miles. In 2000 dollars, that's about \$422 million - about \$19 million per mile. Why so cheap? Because much of Baltimore's LRT system was built using existing railroad right-of-way, "probably the lowest-cost type of LRT alignment to install," notes "Light Rail Progress" (August 2000).

Similarly, in Los Angeles, the 17.3-mile Exposition Boulevard corridor near the Santa Monica Freeway would be relatively low-cost to build because the MTA already holds title to the right-of-way, and an old rail line could tap state and federal transit funds committed to the service area.

Sacramento's LRT opened in 1987 with an 18.3-mile system, now expanded to 20.6 miles. A model of cost containment, the system was built for \$176 million (\$228 million in 2000 dollars) - about \$12.6 million per mile - including vehicles and maintenance facilities.

Cost was kept down by using single-track sections with passing sidings to enable two-way train movement. Gradually the line is being double-tracked as ridership and public approval have

grown. Also helping to keep costs down were use of over 7 miles of rail right-of-way and 4.5 miles of highway right-of-way on an abandoned Interstate system project. Less than 5 miles of the line was built on city streets. That and a small amount of bridgework and aerial construction were the most expensive elements in the original system.

The Policy Research Association of Canada notes one constraint, "Commuter rail makes economic, social and environmental sense in large cities. Where it tends to fall short is that it must co-exist with the monopoly provider of rail access, who gains revenues from freight traffic." This refers to the major problem in inter-city commuter rail and high-speed rail plans, which must accommodate passenger and freight rail moving at different speeds on the same tracks.

Supporters argue that system construction costs for light rail systems should not be viewed in isolation but in the context of alternative outlays. In "Commuter Rail's Compelling Case," the Policy Research Association of Canada argues that surface rail systems can relieve roadway congestion without the capital costs of subways. Because of underground track, subway costs can range up to \$200 million Canadian per kilometer (equivalent to \$200 million U.S. per mile), making them effectively out of reach for cash-strapped municipalities.

Light rail costs must also be weighed against auto-only alternatives, say the Canadian analysts. In greater Toronto, GO Transit carries 135,000 commuter rail passengers each weekday into and out of the downtown core. Serving these people by SOV would require 400 acres of downtown parking and three more major multi-lane expressways. (Their analysis of light rail, subway and auto does not include bus system costs).

Tri-Met, Portland's regional transportation agency, estimates 75% of riders on the MAX light rail system have access to a car. At 1.2 persons per car, the recent monthly growth rate of 1,000 total trips per day meant that 312 more cars were removed each month, on top of the approximately 22,000 cars MAX was already removing each weekday with its base ridership. About half these trips were downtown, where MAX reduces the need for additional parking spaces on expensive central city land at a capital cost is about \$10,000 per space.

Paul Nussbaum, senior director of business planning for Amtrak, advocates a larger share of transportation spending for passenger rail. He says pouring money into other modes has reached a point of diminishing returns.

Nussbaum cites a recent proposal to expand Interstate 95 in Connecticut at estimated costs of \$50 million per lane-mile - the equivalent of about 45 passengers per hour for every \$1 million invested. He estimates a comparable mile of 125-mph rail would cost about \$8 million - the equivalent of 450 passengers per hour for each \$1 million invested, or 10 times the highway example.

"Yet," concludes Nussbaum, "The U.S. invests less than 1% of its transportation dollar in rail versus about 15% for our European counterparts. Federal spending in 2001 will be \$33 billion on highways, \$13 billion on aviation, and \$0.5 billion on rail. To fill this gap, since 1996, 21 states have made capital investments in rail totaling more than \$850 million."

"Today our nation spends \$80 billion a year on its highway system and \$19 billion on

its aviation system," Nussbaum observes. "Yet, hours of highway delay in the largest 69 metro areas have nearly tripled since 1982 and flight delays have grown 33% in the last five years."

Does spending more on a given mode relieve congestion or add to it? In this argument, it seems any number can play. The Surface Transportation Policy Project says in the 1990s, residents of the 23 metro areas that added the most new road capacity per person saw the annual number of hours stuck in traffic rise by 70.4% while the 23 metro areas that added the least capacity experienced a 61.9% increase.

The Texas Transportation Institute, source of the annual Congestion Index, offers findings that favor roadway-based transit. "Suburbanites will ride buses when the service is reasonably fast and convenient. No evidence exists that rail transit systems reduce congestion. Between 1987 and 1991, the congestion index grew 7% in the average rail city and 4% in the average non-rail city."

Operating costs: bus versus rail

An important advantage claimed by light rail supporters over buses is lower operating costs due to the ability of rail to couple multiple cars in one set with a single train operator.

"Light Rail Progress" (April 2001) cites the 22-mile Los Angeles Blue Line as an example. Currently, an average 56,225 daily riders are served by 20 morning peak trains, 10 off-peak trains and 19 peak afternoon trains - all in 2-car mode. A parallel road route, California Highway 60, has 115 buses, which serve 26,690 weekday riders, and acts partly as a feeder for the Blue Line.

"Light Rail Progress" analyzed what would be required to serve all riders in the corridor with bus-only service. Even if trains were limited to two cars by platform lengths, bus service costs were estimated at about 43% higher, requiring 482 buses to serve the 56,225 Blue Line riders. The Los Angeles transit agency is recon-

structing stations to handle 3-car trains, which would lower operating costs to an estimated less-than-half that for comparable bus service.

Buses were assumed to operate at \$104 per bus hour while a two-car LRT train was priced at \$688 per train hour and a three-car train at \$946. Average schedule speeds of 12 mph for buses and 24 mph for trains were assumed. Lower bus speeds serving the route are compensated for entirely by the use of extra buses.

“Light Rail Progress” noted that bus proponents argue the comparison should be made with a busway that has the same dedicated right-of-way as the rail line, rather than surface streets in the same alignment. This would increase bus speeds but also adds to cost of operation for security and maintenance.

The National Resources Defense Council, in an October 1995 study, “The Price of Mobility: Uncovering the Hidden Costs of Transportation,” estimated national average transportation costs by mode. Their findings are shown below in cents per passenger mile traveled.

Mode	Societal	Government	Personal	Total	% of miles
Auto	14	2	27	43	85.3
Bus	4	20	12	36	1.2
Rail	4	32	14	50	0.7
Air					12.4
Walk					0.3
Bicycle					0.1

NRDC’s analysis reveals that there is little difference between the total average cost per passenger mile for each of the three modes. The difference lies in where cost impacts fall. All three modes are subsidized to a significant degree. About 85% of the subsidy for automobiles are in the form of “external” costs imposed

on society in the form of air pollution, land consumed for roadways and parking, and accidents.

In contrast, buses and rail receive their subsidy primarily in the form of direct government expenditures. The virtue of this form of support is that it is easily scrutinized while the subsidies automobiles receive are hidden, not readily quantified, and widely spread across society. The vulnerability of transit funding is that it is provided largely from taxes, which may face voter resistance. Yet it is also true that the electorate in many urban regions has proven willing to support tax levies for financing rail transit systems.

Comprehensive cost-benefit analysis

David Goldstein of the Natural Resources Defense Council notes that “the question is whether the costs of a *particular* light rail system is large compared to the alternative. Moreover, the correct comparison is between the incremental cost of systems that are comparable in providing levels of mobility and access, especially with regard to

maintaining specific levels of service during times of peak congestion.”

Goldstein’s point is important in several regards. First, static comparisons of existing systems are in practice less important than the potential cost of new systems because the

decision to add capacity carries a far greater cost impact than continued operation of existing systems. Further, as metro areas become larger and more densely developed, land values and construction costs rise, with varying impacts by mode. Also, congestion itself limits the potential to which any single transit mode can meet all ser-

vice needs (this point is addressed below in the closing part of the next section, “Impact of rail on total transit ridership”).

Combining the costs of construction and operation might be expected to provide some measure with which to compare the investment in various modes. This task is complicated by three factors: subsidies and other hidden costs that must be identified and allocated to each mode, difficulty of “pricing” costs and benefits for environmental and social impacts and outcomes, and use by protagonists of conflicting data sets.

As a result of these limitations, we are left with an intriguing set of propositions rather than definitive tools for analysis. For example, Weyrich and Lind argue that support for transit simply levels the playing field. “The dominance of automobiles is a product of massive government intervention in the marketplace, stretching back to World War I. “

They cite data that suggest, because of auto-related costs of roads, parking and drive time, the use of a transit alternative generates annual cost savings of between \$61.9 and \$78.1 billion. Given their focus, one assumes these numbers relate significantly to rail.

Lewis and Williams, in “Policy Planning as Public Choice: Mass Transit in the U.S.,” (1999) claim that “annual transit returns outpace costs when all impacts are accounted.” They offer a barrage of statistics purporting to show that during the 1990s, transit returned the following annual benefits: \$23 billion in affordable mobility for households without access to cars or who cannot drive; \$15 billion in reduced congestion delays; \$10 billion in reduced auto ownership costs; \$12 billion in reduced auto emissions; \$2 billion in reduced human services agency budgets (due to work-related mobility provided by transit); and a 2% gain in annual property tax receipts from commercial real estate.

The obvious difficulty with these numbers is pricing methodology: how to quantify a wide range of impacts using a single yardstick (dollars). In Northwest Environmental Watch (1996),

Alan Durning claimed that “the price Northwest motorists pay for each mile they drive is 37 cents but the full cost is \$1.05.” In 1998, the Washington State Transportation Authority said “On a 30-mile round trip, the commuter saves an average of \$176 per month by taking transit. Commuting by car costs six times as much as bus service.”

The American Public Transit Association noted that in 1998 the AAA estimated average annual costs of a single-occupancy auto at \$4,826 for a small car and \$9,685 for a large car. APTA contrasted this with annual costs for using public transportation in a range between \$200 and \$2,000.

These citations make it clear that many numbers can play. Moreover, many analyses treat the comparison as auto-versus-transit rather than bus-versus-rail. One issue that Bundy has berated transit agencies for is failure to use true cost accounting in encouraging transit use by providing park and ride lots at public expense, raising the issue of whether free parking is a prime motive for transit use.

An inadvertent verification of Bundy’s concern is this description in “Light Rail Progress” of the opening of a new route in Denver:

“The new LRT line was virtually mobbed by commuters, but planners had apparently underestimated the potential demand for parking and rail commuters jammed RTD’s parking lots. Drivers eager to ease their commutes rolled into the newest Park-n-Ride lots Monday only to find they couldn’t park. Many parked illegally on medians in the lots; others ignored street signs and parked on adjacent streets. Police have been very lenient about illegal parking. The LRT is advising drivers to park at other lots along the line that are not full.”

In a turnabout on the issue of relevant costs, Fred Salvucci of MIT adds a caveat to Bundy’s approach: “I’m disturbed to see people who call themselves environmentalists use least-cost pricing because this often excludes environmental costs.”

Martin Wachs notes there are not only bus-rail issues but also fixed route-flexible route choices. Wachs urges planners to “concentrate on the most productive markets and corridors for fixed route service and use dial-a-ride or ‘smart shuttles’ in the suburbs rather than expensive bus or rail lines.”

On a larger issue, Aaron Ostrom of 1000 Friends of Washington argues that even true-cost or “value” pricing will not lead to transportation demand management (TDM) strategies that can address “increases in demand on the scale that is coming. TDM must be partnered with substantial transportation alternatives. You can’t chase people out of their cars, with penalties or incentives, until you have an attractive alternative to chase them to.” In Ostrom’s view, “Light rail is that alternative.”

Impact of rail on total transit ridership

“Light Rail Progress” (March 2001) claims that “LRT has an excellent track record for exceeding ridership projections.” Bundy and other critics dismiss this as a point of little significance since it deals with expectations that can be manipulated by low-balling projections, and it reveals nothing about total trip-shares in the region relative to investment per passenger-mile.

That said, ridership estimates on light rail have been exceeded at the outset and have met milestones ahead of time in cities including Dallas, St. Louis, Portland, Salt Lake City, Baltimore and San Diego.

Bundy argues that rail plays a dubious role in luring people from buses into nicer but vastly more expensive transit vehicles, while failing to stem declines in transit use and even sharper declines in transit’s share of trips as metro area travel grows.

“Light Rail Progress” (March 2001) takes on this view directly: “Light rail opponents charge LRT ‘robs’ bus service and overall system ridership plummets. This is the opposite of the truth. In almost every new LRT system location,

total transit ridership has soared.”

The same article lists factors supporting this outcome:

- LRT is cheaper to operate than bus, and the cost savings can be passed on to improve bus service.
- Bus routes can be restructured to interface with light rail, thus attracting new bus ridership.
- Rerouting buses to support LRT routes in suburbs provide new transit access between suburban origins and destinations.
- Transit as a whole gets a better image thanks to LRT, and many who never previously used transit will hop on a bus, often to access LRT service.

Experience in several metro areas challenges the argument that rail siphons off so much money that overall transit service is degraded and ridership declines.

Since Portland launched MAX light rail in 1986, bus ridership is up more than 35% while MAX annual ridership has tripled between 1986 and 1999.

“Light Rail Progress” concludes, “Critics will argue that car trips could be averted if motorists just took the bus on existing roadways. But before MAX, people weren’t taking the bus - they were gradually abandoning transit. Critics can disparage the impact of removing just a few hundred cars a month, but as this analysis indicates, it is significant.”

Since St. Louis opened MetroLink in 1993, total transit ridership has climbed by 16.5 million riders, or 44%. Prior to LRT, the bus transit system was losing about 2.4 million riders per year. At that rate, ridership today would be about 25.3 million rather than 53.9 million. Thus, LRT helped to more than double transit ridership over what it would have been.

In Los Angeles, the 17.4-mile heavy rail Red Line to the San Fernando Valley opened June 24, 2001, extending the previous 11.1-mile line.

Ridership on the Red Line jumped from 65,150 person-trips to the goal of 100,000 per day - an increase of 17,000 people leaving their cars and making round trips on the train. One week after opening the extension, the line was registering 120,500 daily boardings, an 85% increase.

In Dallas, DART expects to handle more than 97 million passenger trips in 2001 to meet its goal of doubling total ridership since 1996 when light rail started. DART serves 2 million people in 12 cities covering 790 square miles. It has 805 buses, 52 light rail cars, 12 transit centers, two transfer stations, 261 shelters, 1,590 miles and 18 miles of HOV lanes. DART shows that bus service can co-exist with extensive rail service.

Sacramento's LRT carries almost 30,000 passengers per weekday. In 1999, light rail carried about 30% of total transit ridership on 1.4% of transit routes, with less than 1% of total stops and about 17% of total vehicles. System-wide boardings rose 88% - from 14 million in 1987, when LRT service began, to 26 million in 1997.

A study of the 1990 census by the Transportation Research Board of the National Academy of Sciences reported that light rail ridership in Sacramento's suburbs was 60 to 70% higher than on equivalent bus service. The conclusion: "Rail transit seems somewhat more attractive than bus to affluent suburbanites who are traditionally wedded to travel by car." 60% of the LRT system's riders are on non-commute hours, indicating people aren't using light rail just for trips to work but for shopping and recreation.

Growth in light rail does not seem to be associated with a decline in transit use. Lester Brown, in the *Worldwatch* 2001 annual report, says transit ridership in the U.S. is growing 4.5% a year versus 2% for auto use.

Weyrich and Lind, in their "conservative critique of anti-transit myths," observe that "from the model T until 1996, transit was in decline nationally. Since then it has been growing and in 1999 and 2000 grew faster than auto use, reaching 9.4 billion trips in 2000."

The authors believe "the main reason for this growth is the high quality of rail transit service" and add that where light rail is available, there is high demand. "People will take rail as opposed to having to drive." They cite data showing that of the ten cities that added light rail since 1980, seven saw "significant" increases in total transit ridership.

There are also cases where transit use has grown steadily absent a light rail system. In the Puget Sound region, the Washington State Transportation Authority reported that transit ridership grew 63% from 1990 to 1998. Four regional systems were among the fastest growing in the nation - this in an area served by bus but not light rail. Among regular riders (5 trips or more per month), 77% have access to a car while 23 % are transit-dependent.

Can rail actually benefit bus service? Aaron Ostrom of 1000 Friends of Washington believes the proposed Link light rail system "will improve travel time for many current bus users and free up bus service hours. Estimates are that it will save a net 2.2 million hours annually for former bus riders and will free up about 300,000 annual bus hours for redeployment."

Ostrom's hope is that those who switch from bus to rail will travel faster than before, and those who stick with the bus will save time because of better routes that minimize transfers and better serve user needs.

This touches on a crucial point often overlooked in the rival claims of those who emphasize one mode of transit over another: the potential for an optimal balance between bus and rail.

In May 2001, the Los Angeles County Metro Transit Authority (LACMTA) unanimously voted to proceed with an LRT plan along the Exposition Blvd. corridor rather than a busway plan. Yet, LACMTA also approved major bus service improvements on the roughly parallel Wilshire Blvd. Corridor, one of the most intensive, high-volume single transit corridors in the world. This "Better Bus" service operates in mixed traffic and will be upgraded with signal

prioritization, purchase of more buses, construction of new stops, and rebuilding of curbs and lanes.

A major factor for going with rail on the Exposition Blvd. corridor is that bus headways of 3.3 minutes at the west end and 1.5 minutes at the east would have meant interrupting cross-traffic an average of every 45 seconds. Furthermore, a 55-mph speed was assumed even though California law does not provide for gate-protected intersection crossings for buses.

The LACMTA decision seems to be a case of sensibly balancing transit modes, with buses on Wilshire and rail on Exposition. To go exclusively with one mode is to come up against severe constraints. The same point has been made in Seattle. A bus-only approach to long-term transit demand maxes-out street capacity while a rail approach maxes-out funding capacity (and crowds out facilities like the Seattle tunnel if it is the primary mode). An optimal balance such as LACTMA sought appears to be a better alternative.

Rather than viewing bus and rail as an either-or, a regional system perspective suggests different capabilities to meet different needs. In areas with severe congestion like Los Angeles or Seattle, traffic is so bad it requires multiple responses based on the strengths of each mode - for example, the greater flexibility of buses and rail's high capacity relative to footprint.

The point is underscored by an analysis of the Texas Transportation Institute's Congestion Burden Index (CBI) by Surface Transportation Policy Project (May 2001). STTP concluded, "The CBI quantifies the combined effect of congestion and the degree to which people are exposed to it. The burden of traffic congestion on commuters is considerably less when they can choose from a variety of transit options." This suggests offering a mix of bus and rail.

Fred Salvucci, former DOT secretary for Massachusetts, makes these points about the beneficial interaction of bus and rail in an integrated transit strategy:

- Almost every large city needs both bus and rail. Only Manhattan has the density that allows rail to serve everywhere. It is destructive to finance rail in a way that undermines bus. Yet, it is also better to use transportation funds to support rail than to build more highways.

- For many cities, the best overall approach is to "build out" the bus system to its full capacity while planning for rail as the next future step. The strategy is to get the maximum bus system in place and then add rail. Since bus equipment has a 12-year life, not a 30-year life, with new buses cities can buy 12 more years of planning and finance time before converting to rail.

- Grade separation is crucial and this is the ultimate advantage of rail in a complex urban setting. One approach to spread costs is to construct future rail routes with dedicated rights-of-way and begin service with buses.

Impact of rail on transit service in lower-income communities

Critics have charged that LRT serves affluent users while buses serve those who are less affluent and transit-dependent. In a celebrated Los Angeles case, the MTA was charged with diverting resources to heavy rail lines linking downtown with the suburbs, while starving funds for inner-city bus routes.

In September 2001, an appeals court ordered the MTA to comply with a 1996 consent decree that would reduce the number of persons standing on buses. MTA was told to buy hundreds of buses to meet this goal.

Reporting on this event, "Light Rail Progress" blandly concluded, "There is no evidence, however, that poorer riders are badly served or are avoiding LRT."

It continued with a rather complex argument: Light rail systems carry a lower *percentage* of lower-income groups while typically winning a higher *number* of riders from lower-income

groups. LRT makes the ridership base bigger by adding riders from higher-income groups. Those from lower-income sectors don't increase as rapidly "because unemployment is higher among these groups and transit is particularly useful for work-trip commuters."

As an example, "Light Rail Progress" cited San Diego's East Line, which was first extended to East San Diego, where it served the poor. LRT initially attracted 4,500 weekday riders while the bus lines had about 3,000. When the East Line was extended to the suburbs in 1990, ridership jumped from 4,500 to 17,000 per weekday and the proportion of poor dropped from nearly 100% to about one-third. "But there was a net increase in lower-income riders. And an expanded system gave them more opportunities to ride to good jobs."

In a 1995 paper, "Is Rail Transit Right for Your Community?" Hank Dittmar of the Surface Transportation Policy Project addressed criteria that measure how well transit serves social equity.

Dittmar says the key social equity question is, "Will the proposed system increase overall and individual access to jobs, services, markets and opportunities?" Related questions include:

- Is the rail link being integrated into the existing transit and para-transit service in a comprehensive way - operations, service and fares?
- Is pedestrian system access being given equal weight with driver system access?
- Is the role of transit in providing backup and redundant systems being considered?
- Does this enhanced access serve the transit-dependent population as well as the so-called choice riders?
- Is rail access being provided to communities of color and low-income communities?

- Have they been involved in the decision-making process?

- Is rail complementary to bus service or does it replace bus service?

Aaron Ostrom, in an August 2000 paper, "Why Light Rail," argues, "The L.A. situation is bad but completely different (than Seattle's proposed Link). Light rail directly competes for funding with buses that serve communities of color. They are operated by the same agency while in Seattle light rail and local bus service are operated by different agencies with independent funding sources."

Ostrom's argument is less than fully persuasive as a response to the Los Angeles example. Among rail skeptics, the real issue is not about conflicts within agency budgets. It is about massive diversion, even exhaustion, of regional funding and political capacity to support transit systems. They point with alarm to the high costs of rail relative to the ridership it will gain from the population that needs or wants to be served by transit.

MIT's Fred Salvucci tries to broaden the focus. He notes that "Bundy charges rail is regressive because it comes from bus funding - but it doesn't need to. It can come from any transportation source."

Puget Sound policy analyst Preston Schiller observes, "For an urban transit system to work, a service and marketing ethic must prevail, as contrasted with being dominated by an operations ethic." Schiller concludes, "Overall, transit planners should work vigorously to provide priority for buses while planning for a rail future."

Relevant measures of market share

In "Does Transit Work? A Conservative Reappraisal," (1999), Paul Weyrich and William Lind note that "The principal case against transit is the 'one percent argument' - the assertion that transit carries only about 1% of total trips. A better mea-

sure of the effectiveness of transit is its share of trips in which transit can compete.”

Weyrich and Lind argue that transit’s ability to gain market share can be rated only in the case of “transit-competitive trips.” These depend on three factors:

- Availability. Transit can’t compete where it doesn’t exist. Almost half the households in America are in locations where they have essentially no access to transit. Thus, trip share is zero.

The two authors argue that transit funding to extend rail systems increases ridership and is cost-effective. They cite San Diego, which almost doubled the length of its light rail line and saw ridership grow from 35 million to 62 million. In 1985, 26.9% of transit riders were former SOV users; by 1990 that figure had risen to 36.9%.

- Quality. The majority of Americans have access to at least one car. If available transit is of poor quality, they will be likely to choose the auto. “Quality bus and rail transit is safe, clean, comfortable, on time, and has pleasant stations with adequate and reliable parking,” say Weyrich and Lind.

- Trip purpose. Even in its heyday (the 1920s), transit was not competitive for errands, shopping, doctor and dentist trips. The most important category of transit-competitive trips is commuting, followed by entertainment trips.

Another perspective on the “one percent argument” is offered by Seattle civic leader and Metro transit founder Jim Ellis. “The real test of a bus or rail transit system is not total trip share in the metro area but rush-hour trip share, especially to and from the central business district (CBD).”

A body of data support Ellis’ point. Downtown bus service is a popular choice. Over 40% of trips to downtown Seattle and 30% of peak trips to the University District are on transit. In

Chicago, 50-60% of trips made to the CBD are by transit. METRA light rail’s share was 21% in 1990 and has probably risen. METRA recently added rail service that is 97% on time and averages above 60 mph.

Nationwide, an estimated 54% of all transit trips end at workplaces. The challenge for transit in serving metro area growth arises from increasingly complex travel patterns. The Urban Land Institute addressed these a decade ago in “Transportation and Growth: Myth and Fact.”

ULI reported that, in most growing areas, getting people to downtown jobs is no longer the main transportation problem. Commute patterns have become much more diverse.

In shares of increase between 1980 and 1990, 58% was suburb to suburb, 20% was suburb to central city, 12% was central city to suburbs, and 10% was central city to central city.

Between 1960 and 1990, suburb to suburb commuting rose from 11 million to 38 million commutes, suburb to central city from 6 million to 17 million, central city to suburb from 2 million to 7 million, and central city to central city from 17 million to 25 million.

In 1990, of all weekday vehicle trips, 56% were non-peak hours, 18% were 4-7 p.m. non-work trips, 12% were 6-9 am work trips, 10% were 4-7 p.m. work trips, and 6% were 6-9 am work trips.

When transit is judged by its ability to serve all types of personal travel, the glass appears half-empty. When the focus is on transit’s share of peak-hour trips to job concentrations, the glass is half-full. Ellis argues that the only fair way to measure the cost effectiveness of transit is to compare it against alternative investments in infrastructure capacity that would be needed to support non-transit travel, especially for peak-hour CBD trips.

Speed, safety and reliability

Supporters of each mode - auto, bus and rail - agree that travel time advantages are a factor in competitiveness. Responding to a claim by rail foe Wendell Cox that new LRT systems average 17.2 mph and the fastest at-grade system operates at 18.2 mph, "Light Rail Progress" says modern LRT averages above 20 mph while local-street buses average 12-13 mph. LRT is competitive with auto speeds of 23-25 mph in urban traffic conditions (a mix of freeways, arterials and local streets).

Specific examples from schedule and route data in respective cities:

Baltimore	24 mph
Dallas Red Line	21
Dallas Blue Line	19
Denver / Alameda-Littleton	38
Denver / Downtown-Littleton	26
Los Angeles Blue Line	24
Los Angeles Green Line	38
Salt Lake City	24

Critics, says "Progress," often use Federal Transit Administration data that include layover time at the end of routes - which of course doesn't affect riders. These measures also include older streetcar-type LRT in Boston, San Francisco and Philadelphia, which skew the data downward.

Weirich and Lind argue that rail transit is fast and relieves congestion, and they cite a national survey finding that 43% used public transit because it is faster than using a private automobile. In particular, they argue that, thanks to grade separation or preferential right-of-way, rail is a faster ride during rush hour than an auto or bus moving through congested urban streets or along freeways.

The Texas Transportation Institute's 1999 Urban Mobility Study indirectly supports this view. It found that the greatest increases in congestion have been in areas that do not have rail transit.

Other analysts have focused on ways to give buses the same travel time edge as rail. Todd Littman of the Victoria Transportation Policy Institute (1999) argues that bus-based "transit offers a major gain in travel time with HOV lanes, separate rights of way, and preferential traffic controls.

Puget Sound policy analyst Preston Schiller also supports "transit priority" - favored treatment over other vehicles in general traffic, such as special lanes and signal preemption - and grade separation where necessary. He notes the importance of achieving "travel times and costs that are competitive with the automobile" and expresses concern that on the regional bus system, "multiple transfers and awkward routes undercut this goal."

A regional transportation agency staff memo in Seattle (1992) argued that "for rail to attract new riders over a bus alternative, it must provide a significant improvement in access and/or travel time. Otherwise it will carry the very same riders that buses would carry, in nicer vehicles at much higher cost."

In "Why Light Rail?" Aaron Ostrom sees rail as having an inevitable edge: "A reliable, high-capacity transit system must be able to carry thousands of people in a corridor during peak periods. Such a system must have its own right-of-way to ensure that it offers a reliable alternative in the face of traffic congestion. Light rail provides that capability."

Martin Wachs of the UC Berkeley Transportation Institute makes a distinction between speed and technology on the one hand, and safety and reliability on the other. "Transit proponents tend to advocate more extensive systems and expensive capital investments in underground rail systems, exotic people movers, monorails, and mag-lev trains.

“But there is little evidence these are cost-effective and Americans already pay more in transit subsidies per ride than Europeans do. More subtle and systematic improvements are needed.”

Wachs cites two examples of modest but key improvements:

- Improve security and safety - not only for those riding on transit vehicles but for those walking to or waiting at a transit facility.
- Assure reliability. Transit does not have to move as fast as autos to satisfy its customers. But it does have to be consistent and on time, and it should not require customers to engage in complex planning exercises.

Safety comparisons can be made between autos and transit, and among transit modes. In 1998, the Washington State Transportation Authority reported that death rates per passenger mile were 105 times higher for cars than for transit buses. Todd Litman of the Victoria Transportation Policy Institute says public transit has .66 fatal accidents per billion miles traveled - about 5% the rate of 13.0 for autos.

Conclusion

In many regions of the country, important decisions are being debated on major investments in transportation. The analysis above of the arguments surrounding the rail debate illustrates the complexities and trade-offs involved in making transportation decisions. It also suggests that as rival claims are exchanged by advocates, the public debate fails to fully represent the issues. Rival charges are often made without supporting data or analysis; indeed, even without public insistence that such facts be included in the political dialogue. There is a need to raise the bar on the quality of decision-making in this crucial arena so we can make the right decisions on transit choices.

About Glenn Pascall

Glenn Pascall is Senior Fellow, Institute for Public Policy and Management, Graduate School of Public Affairs, University of Washington. He is economics columnist for the Puget Sound Business Journal, and previously held the same post at the Seattle Times, the Seattle Post-Intelligencer and the Seattle Weekly. Pascall's column won first place in the Excellence in Journalism competition for 1998, sponsored by the Western Washington chapter of the Society of Professional Journalists.

Pascall has taught at the University of Virginia, Sacramento State University and Seattle Pacific University as well as the University of Washington. He was director of research for the California Taxpayers Association and Deputy State Comptroller of the State of California. Pascall is a former revenue director of the State of Washington, served four years as president of the Washington Research Council, and was legislative assistant to Gov. Daniel Evans.

As an economic consultant, Pascall has been project director for economic impact studies of the Boeing Company, the forest products industry, and the impact of Alaska on the Puget Sound economy. As a public policy consultant, Pascall has been coordinator of the projects on affordable housing, regulatory reform, state transportation policy, and public capital financing in the Seattle region. Currently, Pascall is co-director of “Connecting the Gateways and Trade Corridors,” Discovery Institute's Cascadia-region transportation project.

Pascall is author of The Trillion Dollar Budget (University of Washington Press, 1985) and (with Robert Lamson) Beyond Guns and Butter (MacMillan, 1991). He chaired the University of Washington Press Development Board during its first two years of activity, Pascall graduated Phi Beta Kappa from Pomona College and holds a master's degree in public administration from Sacramento State University.

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