Is Expanding Public Transit a Good Investment for the Phoenix Metro Region?

by John Semmens

EXECUTIVE SUMMARY

The Decline of Public Transit

Urban public transportation systems have been in decline since the end of World War II. At that time, public transit vehicles provided 50 percent of travel in urban regions. Last year, about three percent of urban travel in America was provided by public transit.

This decline has occurred despite Herculean government efforts to prevent it. Non-riders are forced to pay three-fourths of the cost of every transit user's ride. Per person-mile of travel, government now spends thirty to forty times as much on public transit as it does for roadways.

The decline of public transit is the result of powerful demographic forces that show no sign of reversal. Basically, the demand for public transit is inversely related to personal income. As people's incomes rise they can afford the more comfortable and convenient travel provided by owning and operating an automobile.

The "race" between the automobile and public transit is over. The auto has won. Nothing short of an economic debacle that drastically reduces urban standards of living can overturn this outcome.

Unwilling to face this reality, public transit's devotees are busy repackaging an early loser in the race (trolleys), hoping that a new name (light rail) and a new public relations campaign can persuade people that the tax increases needed to try to resuscitate this dinosaur are necessary.

Light Rail Transit in Other Cities

Those who would raise taxes in the Phoenix metropolitan region in order to build light rail transit are mightily impressed by the alleged "success" of trolleys in other cities. Many have gone on pilgrimages to places like Portland and San Diego and returned with tales of great wonder and astonishment.

Why, these cities actually have trains. Frequently, there are passengers. Local transit bureaucrats and politicians rave about how wonderful these light rail trains have been for their cities. However, bureaucrats seeking to expand their empire or justify their budgets and politicians who have plowed millions of taxpayer dollars into these ventures have every incentive to exaggerate the benefits.

Inefficient, Unfair, Ineffective

Of all the options in the current public transit mix, for most cities, light rail is probably the worst possible choice. It requires its own special track (at a cost of around $40 million per mile to build), so it lacks the flexibility of buses which can be run over existing city streets. Yet, its carrying capacity is far less than that of heavy rail.

There isn't a single light rail transit system in America in which fares paid by passengers cover the cost of their own rides. The aggregate deficit for 2000 (the latest year for which complete data are available) exceeded $1.4 billion dollars. The average cost per passenger-mile is around $1.50. These costs are far higher than the average cost per bus passenger-mile of about eighty cents. Of course, no transit option matches the average cost of automobile transportation, which, is about thirty cents per vehicle-mile.

Light rail's inefficiency is matched by its unfairness. On average, taxpayers pay nearly 90 percent of the cost of light rail passenger travel. This is worse than the average for all transit modes. When all transit modes are considered, riders pay about one-fourth of the costs. Light rail

compares even more unfavorably with auto transportation where private passenger vehicles currently pay around 100 percent of their share of the cost of the road system.

Light rail's inefficiency and unfairness aren't offset by effectiveness. In no city in America did light rail transit account for much more than one percent of the urban person-miles of travel. The average share of person-miles of travel was only three-tenths of one percent.

Light rail is touted as a means of reducing urban traffic congestion. The claim is that it will lure drivers out of their cars and, thereby, reduce traffic congestion. If all of the light rail passengers had been driving their own cars, light rail would, on average, be removing three cars in 1,000 from the roads. However, studies have shown that about 80 percent of new light rail passengers were former bus passengers. Taking this into account, the real impact on traffic is for light rail to remove less than one car in 1,000 from traffic.

The projected performance of a prospective Phoenix light rail system would likely be somewhat worse than average. Passengers are projected to pay only 5 percent of the cost of their own rides. The light rail system is projected to account for only two-tenths of one percent of travel in the region. Due to the fact that the rail lines will be constructed in existing city streets, light rail in the Phoenix region is actually projected to increase both traffic congestion and air pollution.

Conclusion

The transit numbers tell a tale of inefficiency, inequity, and ineffectiveness. In no city is transit run on sound business principles. There is little effort to try to generate compensatory revenues from customers. Huge and unending losses are the result. Riders are asked to pay a pitifully small share of the costs. Despite generous subsidies, transit in city after city carries only a small fraction of the person-miles of travel.

Modern urban travelers want convenience, comfort, and speed. The automobile best fits these requirements. This is why the auto is the choice for the overwhelming majority of urban travelers. The inconvenient, frequently uncomfortable, and slower transportation offered by public transit modes does not meet the needs of more than a small fraction of urban travelers. Given its inferior performance characteristics relative to other transit options, light rail is the most unappealing choice for trying to meet the needs of the small fraction of urban travelers who rely on public transportation.

Funds invested in the expansion of traditional forms of transit (buses and trains) will be squandered. Little will be accomplished in the way of moving people about town. The resources consumed will be unavailable for use on more effective ways of meeting transportation needs, reducing traffic congestion and improving air quality. Those seeking to lead the community and state to a better future must find more productive ways of using public funds than expending them on public transit.

TABLE OF CONTENTS

INTRODUCTION

Should city, state and federal taxpayers be asked to pay more to fund expansions of existing public transit? That is the question facing governments throughout the nation. It is an issue with which Congress will have to deal as it considers transportation funding authorization legislation. While proponents of increased funding of transit are doing their best to promote increased spending of tax dollars, policymakers would do well to consider the implications before rushing to board the transit "bandwagon." An objective analysis of these implications indicates that the costs appear to far outweigh the benefits.

Admittedly, the purported benefits of expanded public transit are, indeed, seductive. These benefits include the notion that expanded public transit will have a significant impact on reducing traffic congestion and, thereby, make a major contribution to improving urban air quality. Further, it is asserted that expanded public transit is a social welfare program, necessary to help ameliorate urban poverty. Finally, it is asserted that public transit is a "good investment" that will help promote a community's prosperity. It would be great if public transit could make a cost-effective contribution to any of these objectives. Unfortunately, it cannot. In fact, it seems more likely that increasing taxes in order to expand public transit would work against the advancement of all of these objectives.

Our analysis will begin with a view of public transit from an aggregate perspective of the long term history and performance of public transit—most particularly the period since the initiation of federal aid in the mid 1960s. We will also take a closer look at public transportation's latest fad: light rail transit. As we will see, this latest fad is built upon a thoroughly rotten foundation. It has no chance of operating efficiently. It has no chance of making a significant contribution to urban transportation needs.

NATIONAL PERSPECTIVE

Our analysis will begin with a view from a national perspective. This is in recognition that the transit offered in Phoenix is not a totally unique undertaking. Observing how transit has done in the aggregate and in other cities will provide a foundation for evaluating circumstances and proposals in the Phoenix region.

A Declining Industry

Public transit is clearly a declining industry. Ridership peaked during the World War II period at 23 billion or so trips per year.[1] World War II provided optimal conditions for transit ridership. Over 10 million young men were away from home enlisted or drafted into the U.S. armed forces. Few of them owned or could use autos. Automobile manufacturing was discontinued and auto manufacturing plants converted to producing military vehicles. Gasoline was rationed—discouraging the use of autos by those persons who did own them. Under these conditions, public transit was able to capture 50% of the urban passenger miles of travel.[2]

As World War II came to an end and life returned to a more normal peacetime mode, public transit lost most of its market advantages. Ridership declined by about two-thirds, from 23 billion annual trips to between nine and ten billion in recent years[3] (see Figure 1: Number of

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[1] *1996 Transit Fact Book* (American Public Transit Association), p. 77.

[2] Alan Altshuler, Changing Patterns of Policy: The Decision Making Environment of Urban Transportation," *Public Policy* (Spring 1977), pp. 171-203; *Transit Fact Book* (American Public Transit Association, various years), and *Highway Statistics* (Federal Highway Administration, various years).

[3] *2003 Public Transportation Fact Book* (American Public Transit Association), Table 5, p. 31.

Transit Trips). Public transit's share of urban passenger miles fell from 50% in 1945 to barely 3% by 2001[4] (see Figure 2: Transit Share of Urban Travel and Table 1: Transit's Share of Urban Travel).

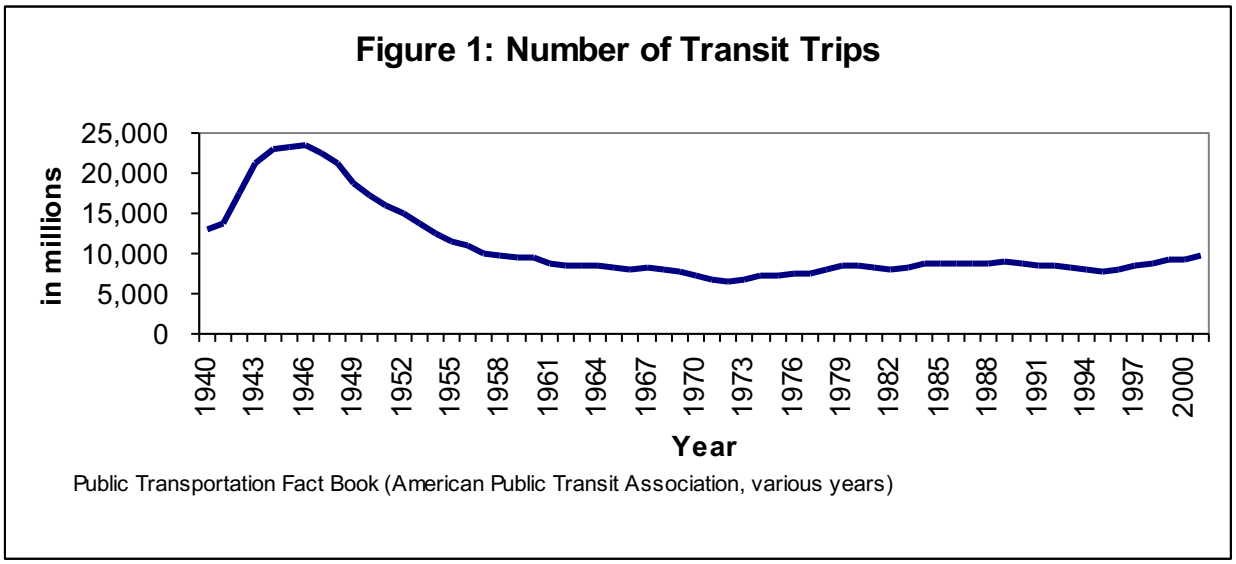
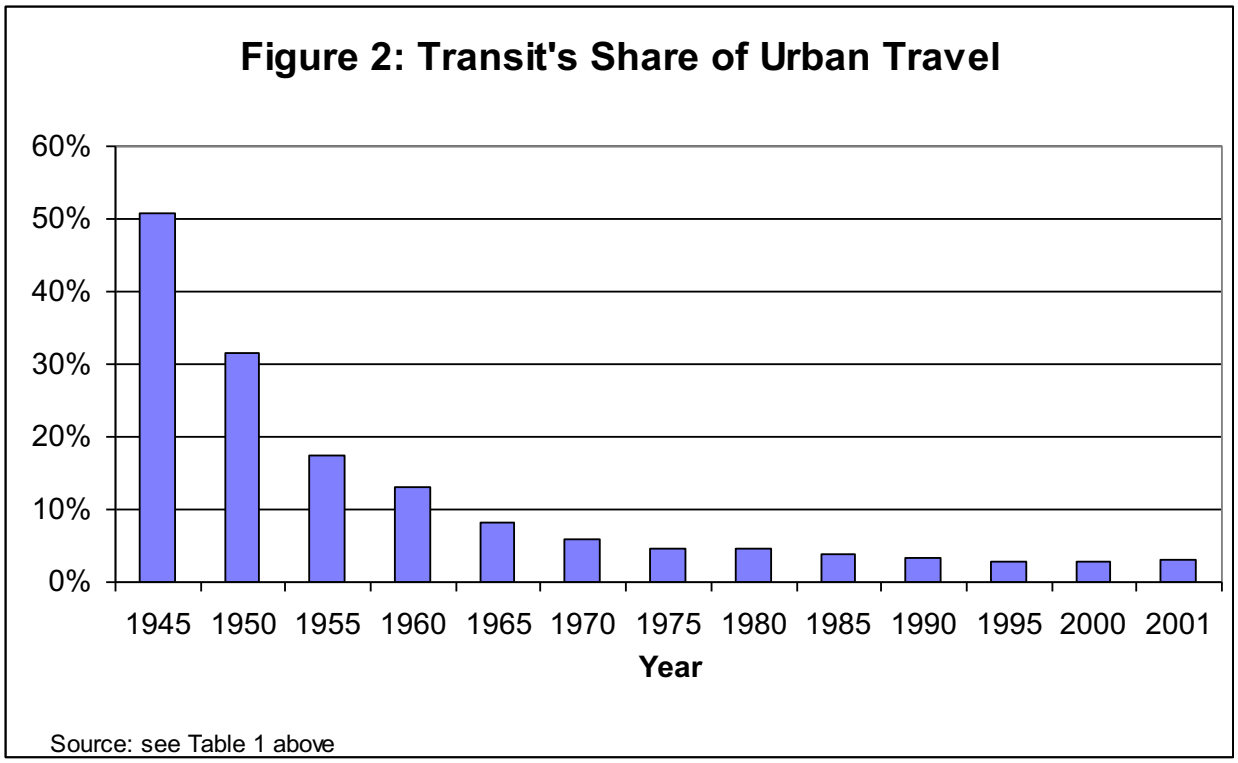


Table 1: Transit's Share of Urban Travel			
Year	Transit Passenger-miles (in billions)	Automobile Vehicle-miles (in billions)	Transit share
1945	112	109	51%
1950	84	183	31%
1955	56	267	17%
1960	46	309	13%
1965	38	420	8%
1970	34	545	6%
1975	34	691	5%
1980	40	813	5%
1985	40	995	4%
1990	41	1,217	3%
1995	40	1,409	3%
2000	47	1,570	3%
2001	49	1,582	3%
Sources: Alan Altshuler, Changing Patterns of Policy: The Decision Making Environment of Urban Transportation," *Public Policy* (Spring 1977), pp. 171-203; *Public Transportation Fact Book* (American Public Transit Association, various years) and *Highway Statistics* (Federal Highway Administration, various years).			

[4] Alan Altshuler, Changing Patterns of Policy: The Decision Making Environment of Urban Transportation," *Public Policy* (Spring 1977), pp. 171-203; and updated figures by the author based on data from the *Public Transportation Fact Book* (American Public Transit Association, various years) and *Highway Statistics* (Federal Highway Administration, various years) and *Commuting in America II* (ENO Transportation Foundation, 1996), p. 49.



Rising personal income increases the ability of families to own autos and houses. Residents without vehicles living in densely populated urban centers are likely customers for public transit. Auto-owning suburbanites are not. Public transit is what economists refer to as an "inferior" good. For a "normal" good, the quantity consumed rises as people's income rises. For an "inferior" good, the quantity consumed falls as people's income rises. Per capita personal income in the United States rose from a figure of $1,223 in 1945 to $30,069 by 2000. Adjusting for inflation of 850% between 1945 and 2000, real per capita purchasing power increased by about 150%.[5] As family incomes rose in the post World War II era, consumers shifted their demand from transit to automobiles as the preferred mode of travel. Once an auto is owned, the heavy fixed costs of ownership (depreciation, insurance, and financing) argue in favor of extending the use of the vehicle as much as possible. Consequently, it should not be surprising to observe that transit trips per capita fell from 175 in 1945 to 33 in 2000, a decline of over 80%.[6] Even in central cities, over 90% of the travel is in cars.[7] Even among the poorest segments of the U.S. population, a majority of the travel is in cars. In the $15,000 and under annual income category, 80% of the travel is in cars. Less than 10% is via public transit.[8] Further, those with incomes under $15,000 constitute a minority of transit riders.[9] The most costly and worst

[5] *Historical Statistics of the United States* (U.S. Department of Commerce, Bureau of the Census, 1975), p. 297 and *Statistical Abstract of the United States* (U.S. Department of Commerce, Bureau of the Census, http://www.census.gov/statab/www).
[6] *Public Transportation Fact Book* (American Public Transit Association, various years).
[7] Erik Ferguson, "Demographics of Carpooling," *Transportation Research Record 1496* (Transportation Research Board, 1995).
[8] *Commuting in America II* (ENO Transportation Foundation, 1996), p. 56.
[9] *Commuting in America II* (ENO Transportation Foundation, 1996), p. 60 and *2003 Public Transportation Fact Book* (American Public Transit Association), Table 12, p. 35.

performing segments of most transit systems are the long-haul routes that extend into the suburbs to serve the more affluent employees of downtown businesses.[10] Far from being a program oriented toward helping the poor, most of the expense in public transit is incurred serving those who would appear quite capable of bearing the cost of their own transportation.[11]

A Financial Disaster

So powerful are the demographic trends affecting public transit that massive subsidies from the federal government have failed to stem the decline. In 1964, the first Urban Mass Transportation Act was passed. At that time about 9% of urban person miles of travel were made on public transit. Today, only 3% of urban person miles of travel are made via transit (see Table 1: Transit's Share of Urban Travel). Since the federal government became involved in subsidizing local public transit in 1964, it has poured over $100 billion into these systems. Over this same time period, local governments have put over $265 billion into subsidizing these systems. Despite this massive investment, per capita ridership has declined from 43 in 1965 to 33 in 2000[12] and the aggregate financial performance of public transit is the worst it has ever been. The deficit between passenger revenues and the cost of owning and operating these systems has gotten larger since the first federal involvement (see Table 2: Transit Financial Performance Since 1965 and Figure 3: Federal Aid & Transit Deficits). By 2001, the aggregate annual loss for all public transit systems combined was over $31 billion dollars. The cumulative loss over the whole 1965 through 2001 period was in excess of $370 billion.[13]

[10] For example, the operating cost per passenger for the express routes in Phoenix (the ones that run only during the peak period to carry downtown workers to and from their jobs) is about $2.40. The system's average operating cost per passenger is about $1.50. See *Short Range Transit Plan FY 1996-97 through 2000-01*(Regional Public Transportation Authority), p. 28 and *Transit Profiles: Agencies in Urbanized Areas Exceeding 200,000 Population* (Federal Transit Administration, December 1995), p. 193.

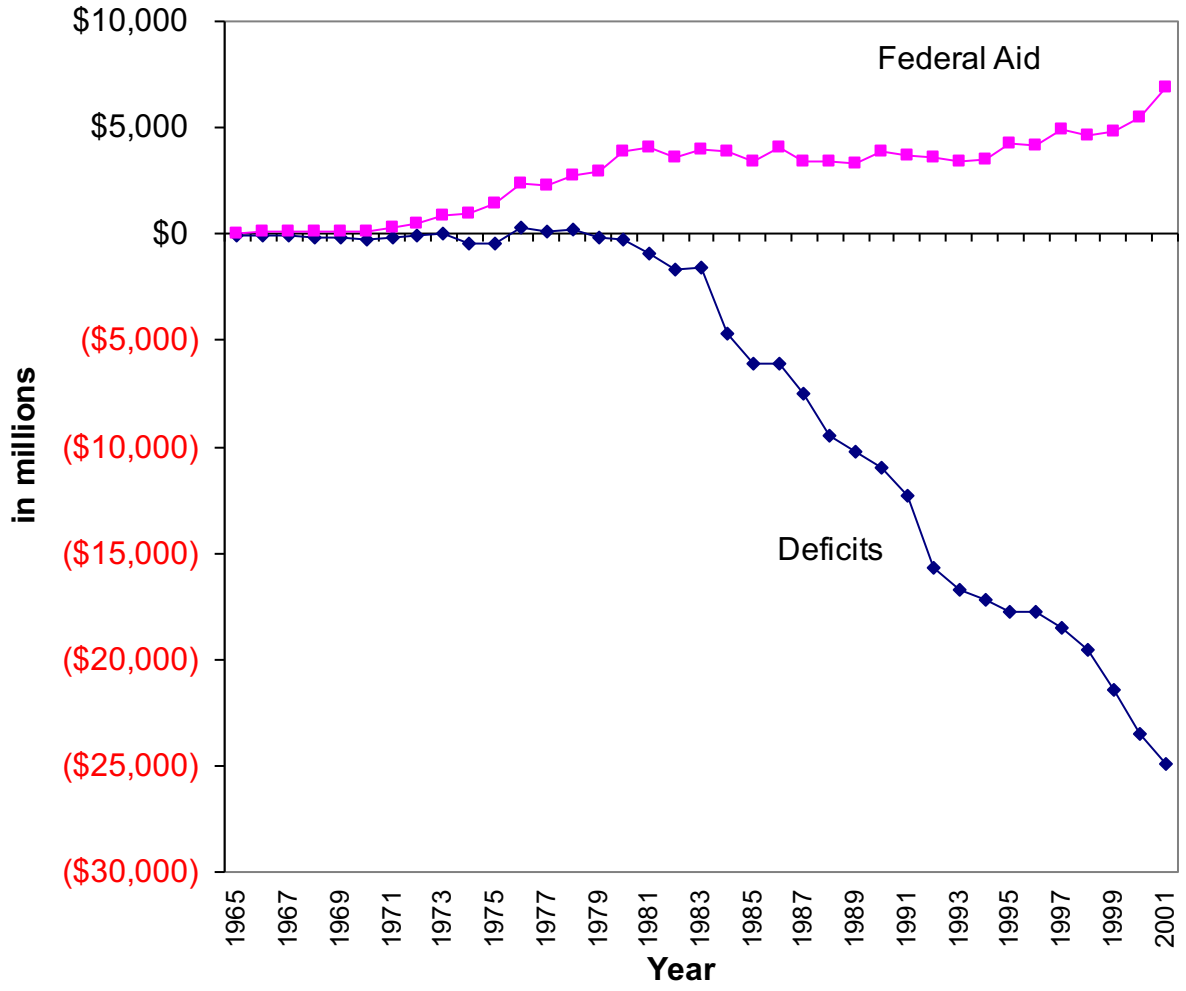
[11] *Public Works Infrastructure: Policy Considerations for the 1980s* (Congressional Budget Office, April 1983), p. 49.

[12] *Public Transportation Fact Book* (American Public Transit Association), Table 26 and *Statistical Abstract of the United States* (U.S. Census Bureau, http://www.census.gov/statab/www), Table 2: Population 1960-2000.

[13] *2003 Public Transportation Fact Book* (American Public Transit Association), Tables 48, 61 & 63.

Table 2: Transit Financial Performance Since 1965 ($ in millions)						
				Federal Aid		
Year	*Revenue*	*Costs*	*Net*	*Operating*	*Capital*	*Total*
1965	$1,340	$1,454	($114)		$51	$51
1970	$1,639	$1,996	($357)		$133	$133
1975	$1,860	$3,752	($1,892)	$142	$1,287	$1,429
1980	$2,557	$6,711	($4,154)	$1,094	$2,791	$3,885
1985	$4,575	$14,077	($9,502)	$940	$2,510	$3,450
1990	$5,891	$20,678	($14,787)	$970	$2,380	$3,350
1995	$6,801	$25,079	($18,278)	$817	$5,481	$6,298
2000	$8,746	$37,781	($29,035)	$994	$4,526	$5,520
2001	$8,891	$40,697	($31,806)	$1,130	$5,769	$6,898
Totals*	**$154,639**	**$526,326**	**($371,687)**	**$22,960**	**$82,641**	**$105,601**
Source: *Public Transportation Fact Book* (American Public Transit Association, various years). *includes intervening years not shown above						

Figure 3: Federal Aid & Transit Deficits



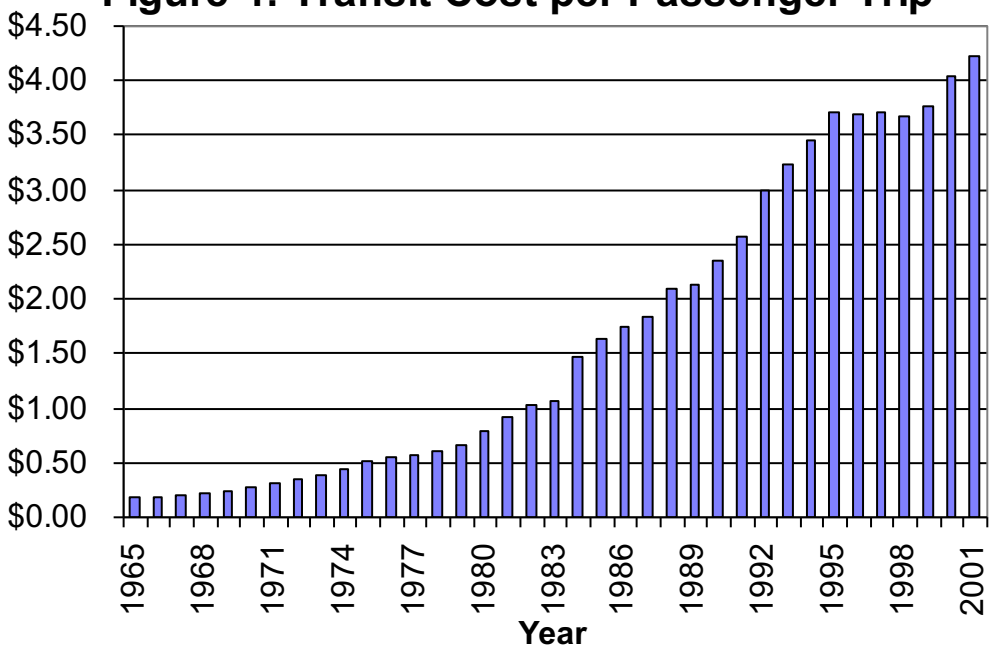
Source: Public Transportation Fact Book (American Public Transportation Association, various years).

Federal subsidies of local transit have come attached to rules that have helped to increase the cost of running these systems. On the one hand, section 13(c) of the Urban Mass Transportation Act (UMTA) obstructs labor cost savings in federally subsidized transit. This federal rule prohibits changes in working conditions that would result in worsening the position of any employee. For example, federally subsidized transit systems may not attempt to save money by replacing full eight-hour per day employees with part time workers. Neither may federally subsidized transit systems substitute split shifts for straight eight-hour shifts.[14] On the other hand, the Davis-Bacon Act helps raise the cost of transit construction by prohibiting competitive bidding on labor costs for federally aided projects. All bidders on a federally assisted

[14] *Trends in Transit Privatization* (Arizona Department of Transportation, April 1986), p. 7.

bus terminal or rail station construction project, for example, would be required to pay the "prevailing wage" in the region where the work takes place. Transportation economist Gabriel Roth estimates that Davis-Bacon rules make federally aided construction projects about 28% more costly than they otherwise would be.[15]

One consequence of this deteriorating financial performance is that taxpayers are being compelled to fund an increasingly inferior service at an increasingly higher cost. The cost per passenger trip on transit has risen from around 18 cents in 1965 to over four dollars by 2001 (see Figure 4: Transit Cost Per Rider). Monetary inflation has raised the general price level by about 450% since 1965.[16] However, transit's per rider costs have risen by more than 2100% during this period. The increase in transit costs has out-paced inflation, indicating that public transit has become increasingly inefficient in accomplishing the task of providing passenger transportation.



Source: Public Transportation Fact Book (American Public Transportation Association, various years).

Before the federal government became involved in subsidizing public transit in 1965, riders used to pay 99% of the costs of their own transportation.[17] Since transit expenses have ballooned out of control, there is no way that the "customers" of public transit would have been willing to pay these soaring costs. This important point is often overlooked in assertions that deficit-ridden public transit is serving a "vital need." The only objective measure of need that we

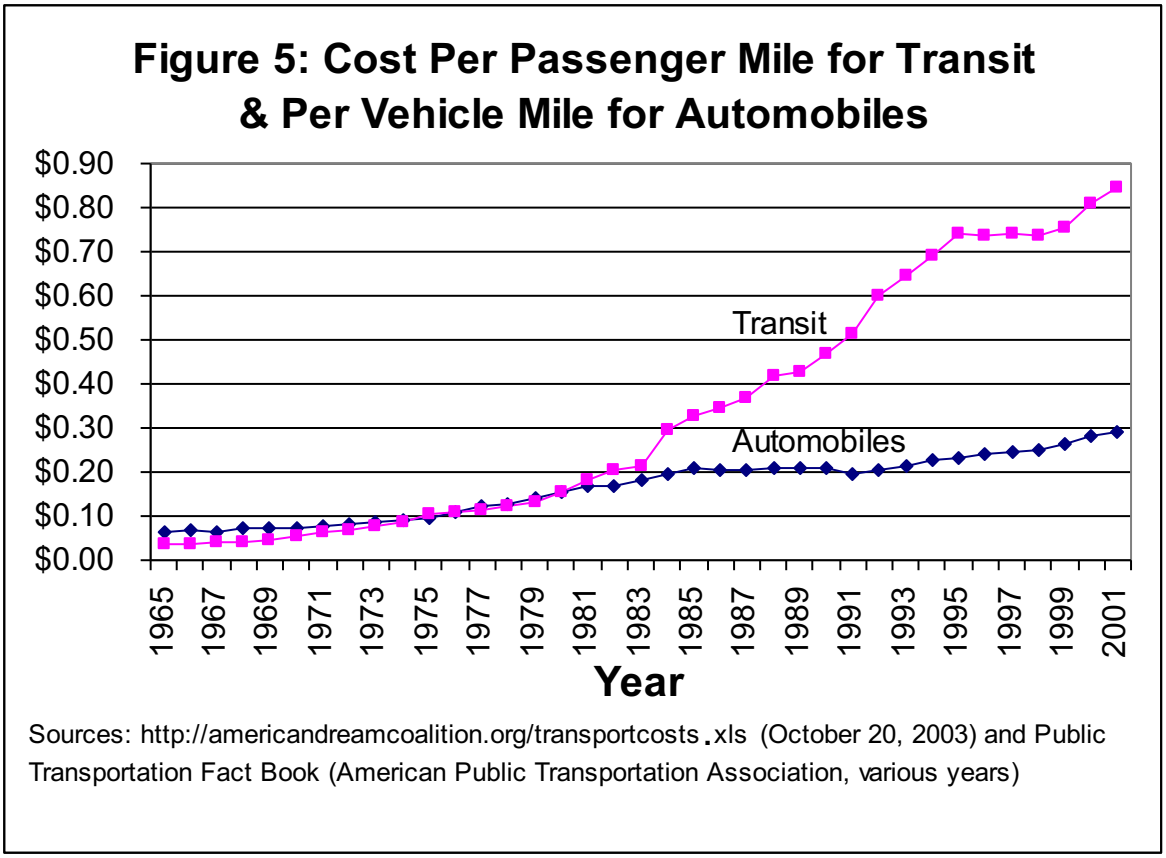
[15] Rick Henderson, "Spinal Tap," *Reason* (April 1997), p.7.
[16] *Statistical Abstract of the United States* (U.S. Census Bureau, http://www.census.gov/statab/www), Table 691: Purchasing Power of the Dollar 1950 to 2000.
[17] *Transit Fact Book* (American Public Transit Association, 1979), pp. 21-22.

can ever have is evidenced by the amount of money customers willingly pay for something. Revenue from paying customers stands as a measure of the value they place on the service. When these revenues are sufficient to cover the cost of providing this service we have proof that a need is being fulfilled. When the revenue from customers is insufficient to cover the cost of providing the service we lack proof that from the consumer's perspective, a genuinely valued need is being fulfilled. The profit that a business makes is verification that it is efficiently meeting customer needs. The losses accruing to public transit are a verification that the assertions of a vital need being met are unsubstantiated. The unwillingness to ask transit riders to pay the full cost of the service is proof that those operating these systems do not really believe that the service is worth what it costs to provide.

The objective evidence is that neither transit riders nor transit providers value the service at more than it costs to provide it. Perpetual deficits mean that all of these public transit systems are converting resources from more valued uses into less valued uses. Individuals would not voluntarily waste their resources in this way. Consequently, the only way that public transit has been able to survive in its present form has been to force non-riders to bear increasingly larger shares of the cost. As it now stands, transit "fare box recovery ratios" (the percentage of operating costs covered by passenger fares) average about 30%.[18] What this means is that if we exclude the costs of buying buses and trains and building tracks, stations, and stops, transit riders are paying about 30% of the cost of their rides. Taxpayers are compelled to pay the remaining 70% of the so-called operating costs. When we consider the total cost of providing public transit, the riders' share of the payment drops to around 23%.[19] Non-riders are paying almost 80 cents of every dollar spent on public transit. Non-riders have to pay over three times as much as riders do for their own transportation.

So inefficient is public transit that it now costs more per passenger mile to travel on transit than it does to travel by car. By the mid 1980s, the cost per passenger mile for transit rides began to exceed the full cost of owning and operating a car. Currently, the cost per passenger mile on transit is about 81 cents.[20] The full cost of operating a car is about 29 cents per vehicle mile (see Figure 5: Transit vs. Auto Costs).[21] So, not only does using transit require customers to walk to stations, wait in the hot sun or driving rain, for a bus or train that may or may not be on time, and perhaps ride standing, this lower quality of service now has a greater total cost per person-mile than the comfort and convenience of riding in a car.

[18] *2003 Public Transportation Fact Book* (American Public Transit Association), Tables 61 & 63.
[19] *2003 Public Transportation Fact Book* (American Public Transit Association), Tables 48, 61 & 63.
[20] *Transit Fact Book* (American Public Transit Association, various years), *2003 Public Transportation Fact Book* (American Public Transit Association), Tables 30, 48, 61 & 63.
[21] The American Dream Coalition, Bandon, Oregon 97411, ph. 541-347-1517, http://americandreamcoalition.org/transportcosts.xls (accessed October 20, 2003).



Inconvenient & Uncompetitive

Financial inefficiency is but one unattractive attribute of public transit's offering to the consumer. Using public transit is a time-intensive mode of travel. An American's average commute to work driving alone in his car is about 21 minutes. The average commute to work by public transit bus is about 38 minutes. The average commute to work by light rail or subway transit is about 45 minutes.[22] Time has value. The subsidies poured into public transit have been unable to bring transit travel times into a range competitive with driving one's own car. Consequently, the time-cost of using public transit makes it a relatively unattractive mode of travel for almost all except the very poor.

If we consider time costs of commuting by various modes, it quickly becomes clear why public transit's share of the urban travel has been shrinking. Using the full costs of operating a car, we find that as income level and an individual's implicit value of time rises, public transit becomes a more expensive mode of travel. (See Table 3: Time and Fare (Transit) or Operating (Auto) Cost of a Trip by Mode.) At all income levels, carpooling offers a lower total cost of travel. At income levels of $20,000 and above, driving alone is less expensive than taking transit.

[22] Alan Pisarski, *Commuting in America II* (ENO Transportation Foundation, 1996), p. 85.

Table 3: Time and Fare(Transit) or Operating(Auto) Cost of a Trip by Mode				
Income level	*car**	*carpool**	*bus***	*rail***
$10,000	$5.24	$3.64	$4.09	$4.66
$20,000	$7.00	$6.03	$7.25	$8.41
$30,000	$8.76	$8.41	$10.42	$12.15
$40,000	$10.51	$10.80	$13.58	$15.89
$50,000	$12.27	$13.18	$16.75	$19.64
$75,000	$16.67	$19.14	$24.66	$29.00
$100,000	$21.06	$25.11	$32.57	$38.35

Sources: *Commuting in America II* (ENO Transportation Foundation, 1996), p. 85 and The American Dream Coalition, Bandon, Oregon 97411, ph. 541-347-1517, http://americandreamcoalition.org/transportcosts.xls (accessed October 20, 2003).
*Auto cost/vehicle-mile = 29 cents; travel time in minutes: drive alone 21.1; 3 person carpool 28.62.
**transit fare per passenger = $0.92; travel time in minutes: bus 37.98; rail 44.92.

The table above tends to overstate the actual costs of using one's own car to commute. Unless taking transit means that one entirely gives up owning a car, a more relevant cost comparison would consider only the variable "out-of-pocket" costs of each auto commute trip. According to the American Automobile Association, this variable cost is about twelve cents per vehicle mile.[23] Using this as our frame of reference, we see that at almost all income levels, driving one's own car to work is a less costly mode of transportation. This would be the case even if transit charged no fares to its riders. (See Table 4: Time and Out-of-Pocket Operating Cost of a Trip by Mode.) That is, the only cost to the rider is the time spent using the transit mode. Is it any wonder, then, that transit's share of urban travel has declined so persistently over the last sixty years? Inasmuch as no amount of money that could be spent on transit systems in the future is likely to have a significant impact on transit travel times, it is clear that transit will never again serve anything other than a very small portion of the urban travel.

Table 4: Time and Out-of-Pocket Operating Cost of a Trip by Mode (using auto "out-of-pocket" costs and transit fares = 0)				
Income level	*car**	*carpool**	*bus***	*rail***
$10,000	$3.20	$2.91	$3.17	$3.74
$20,000	$4.96	$5.29	$6.33	$7.49
$30,000	$6.72	$7.68	$9.50	$11.23
$40,000	$8.47	$10.06	$12.66	$14.97
$50,000	$10.23	$12.45	$15.83	$18.72
$75,000	$14.63	$18.41	$23.74	$28.08
$100,000	$19.02	$24.37	$31.65	$37.43

Sources: *Commuting in America II* (ENO Transportation Foundation, 1996), p. 85 and The American Dream Coalition, Bandon, Oregon 97411, ph. 541-347-1517, http://americandreamcoalition.org/transportcosts.xls (accessed October 20, 2003).
*Auto cost/vehicle-mile = 12 cents; travel time in minutes: drive alone 21.1; 3 person carpool 28.62.
**transit fare per passenger = 0; travel time in minutes: bus 37.98; rail 44.92.

[23] *Your Driving Costs* (American Automobile Association, 2002).

A Blight on the Economy

Some proponents of continued or expanded tax expenditures on public transit argue that spending money in this way is an "investment" that will revitalize a community. The American Public Transit Association (APTA) has published a pair of reports purporting to show that money spent on public transit generates a return that more than offsets the poor financial performances of the transit systems themselves. In 1984, the APTA issued a report entitled *National Impacts of Transit Capital and Operating Expenditures on Business Revenues*. This report asserted that for every dollar spent on rail transit, an additional $3.15 in revenues to other businesses was produced. The figure for bus transit was even more impressive. In the case of money spent on bus transit, an additional $3.50 in revenues to other businesses was generated.[24]

In 1991, APTA issued another report showing high ratios of benefits from transit expenditures. This report--*Transportation Spending and Economic Growth: The Effects of Transit and Highway Expenditures*--claimed that spending on transit had a long-term benefit/cost ratio of 3.29.[25] That is, every dollar spent on transit would generate $3.29 in long term benefits. A press release accompanying the report asserted that a $100 billion "investment" in public transit would yield improved worker output valued at $521 billion over ten years.

In 1997, the "Campaign for Efficient Passenger Transportation" (a coalition of pro-transit organizations) published a report entitled *Dollars and Sense: The Economic Case for Public Transportation in America.*[26] The *Dollars and Sense* report says that public transit "pays a handsome return on investment to the taxpayer, to the business community, to the transit user, and even to the motorist who never uses transit."[27] If these types of returns were actually realized, the case for spending more money on transit would, indeed, be strong. A close examination of the evidence, however, reveals that these claims are false.

In 1999, a report from The National Business Coalition for Rapid Transit asserts that every billion dollars invested in public transit capital projects generates 30,000 jobs, and the same amount invested in transit operations generates 60,000 jobs. The return on investment could be as high as 9 to 1.[28] A study by Cambridge Systematics claims that transit capital investment is a significant source of job creation. That in the year following the investment 314 jobs are created for each $10 million invested in transit capital funding. Transit operations spending provides 570 jobs for each $10 million invested in the short run. Businesses would realize a gain in sales 3 times the public sector investment in transit capital and operations spending.[29]

The touted benefits from transit expenditures sound impressive. However, the analysis suffers from neglecting to disclose two highly pertinent facts. First, the analyses are based on correlations of transit expenditures and historical growth of the economy. Correlations do not

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[24] *National Impacts of Transit Capital and Operating Expenditures on Business Revenues* (American Public Transit Association, 1984), p. 2.

[25] David Aschauer, *Transportation Spending and Economic Growth: The Effects of Transit and Highway Expenditures* (American Public Transit Association, 1991), p. 10. Highway expenditures were depicted as generating only half as many benefits per dollar spent on them (benefit/cost = 1.50).

[26] Donald H. Camph, *Dollars and Sense: The Economic Case for Public Transportation in America*, Campaign for Efficient Passenger Transportation, 1900 L St.., NW, #602, Washington, DC 20036; ph. 202-775-1580 (June 11,1997).

[27] Camph, *Dollars and Sense,* p. 12.

[28] "The Economic Importance of Public Transit," (The National Business Coalition for Rapid Transit, http://65.114.146.18/documents/advocacy_economic_report.pdf accessed October 27, 2003).

[29] *Public Transportation and the Nation's Economy* (Cambridge Systematics, Inc., October 1999), p. E-1; http://www.apta.com/research/info/online/documents/vary.pdf (accessed October 28, 2003).

prove cause-and-effect. They merely demonstrate that two things seem to be happening simultaneously. The simultaneous growth of transit spending and the U.S. economy could be, and is more accurately explained by inverting transit boosters' presumed cause-and-effect. That is, rather than the growth of transit outlays explaining the growth in the economy, it is the growth in the economy that explains the growth in transit outlays. It is ludicrous to hypothesize that spending on trains and buses that have carried a dwindling share of urban travelers has played a significant role in the post-World War II growth of the U.S. economy. A more reasonable hypothesis is that the robust economic growth over the last 50 years has provided the means for both federal and local governments to indulge their transit fantasies. Growth of income, sales, and property values during this timeframe provided targets for the imposition of taxes with which to subsidize money-losing ventures in public transit. Far from being a source of economic prosperity, public transit has survived as a parasite, living off the wealth generated by more productive segments of the society.

The second highly pertinent fact overlooked by the APTA analyses is the issue of "opportunity cost." Opportunity cost is a term used by economists to account for the alternative uses of resources. Money spent on public transit can be shown to employ workers in the construction of rail lines, the driving of buses, etc. This first round of spending furthers subsequent rounds as these directly employed workers spend their wages at supermarkets, department stores, etc. This "ripple effect" is not unique to public sector outlays (though many government "analyses" and boasts appear to assume that it is). All economic activity generates "ripple effects." Before we can conclude that the "ripple effects" of public transit expenditures are a plus for the economy, we need to consider them in comparison with the effects of alternative uses for the money spent on transit.

Taking the 35 years of "investment" in public transit of federal tax dollars as our starting point, we find that public transit spending since 1965 can be credited with assets and returns that currently support about one million jobs.[30] This sounds pretty good until it is compared with the outcomes that might have been achieved if the funds poured into money-losing public transit had been used in some other ways. Since public transit has consistently had a negative return on investment, the assets acquired with the funds put into it have been largely consumed. As a result, the $370 billion in taxpayer money invested in public transit has a current estimated residual value of only $19 billion. If the $370 billion in taxes that has been spent on public transit had been "spent" on a "break-even" investment, the assets would have been conserved and the economy could theoretically have supported 10 million more jobs than it currently does. If the $370 billion in taxes that has been spent on public transit had been "spent" on an investment yielding only a 5% return, the assets would have grown and the economy could theoretically have supported 32 million more jobs than it currently does. The outcomes of these alternatives to transit investments that could have been made are shown in Table 5: Impacts on the U.S. Economy of Alternative Investments.

[30] About 350,000 of these jobs are in the transit industry itself (see *2003 Public Transportation Fact Book* (American Public Transportation Association), p. 53. Another 650,000 are the "ripple effect."

Table 5: Impacts on the U.S. Economy of Alternative Investments ($ in billions)			
	Public Transit	*Break-Even*	*5% Return on Investment*
Amount Invested	$370	$370	$370
Current Value of Residual Assets	$19	$370	$615
Number of Jobs	1 million	19 million	32 million
Source: *2002 Public Transportation Fact Book* (American Public Transit Association, various years).			

Analyses like these are exceedingly "rough" estimates. Everything except the "test variable," in this case, the way $370 billion could have been invested was "held constant." In the real world everything cannot be "held constant." The important point is the relative magnitudes of the impacts of each alternative. Given the sorry financial performance of public transit over this 35-year period, it seems clear that in terms of economic growth, we would have been considerably better off if a number of plausible alternatives to spending the $370 billion in taxes on public transit had been implemented instead. Therefore, when opportunity cost is taken into account, there can be no question that putting money into public transit lowers the economic growth rate, consumes capital, exterminates job opportunities, and worsens the finances of federal and local governments.

Light Rail: The Worst Transit Option

As we have seen, the decline of public transit is the result of powerful demographic forces that show no sign of reversal. Basically, the demand for public transit is inversely related to income. As incomes rise people can afford the more comfortable and convenient travel provided by owning and operating an automobile. The "race" between the automobile and public transit is over. The auto has won. Nothing short of an economic debacle that drastically reduces urban standards of living can overturn this outcome.

Unwilling to face this reality, public transit's devotees are busy repackaging an early loser in the race (trolleys), hoping that a new name (light rail) and a new public relations campaign can resuscitate the public transit dinosaur. Those who tout light rail transit rely mightily upon the alleged "success" of this mode in the cities that have it. Officials from cities without light rail systems go on pilgrimages to places like Portland and San Diego and return with tales of great wonder and astonishment. Why, these cities have trains. Frequently, there are passengers. Local transit bureaucrats and politicians in these cities rave about how wonderful these light rail trains have been for their communities.

The reality is quite different. Of all the options in the current public transit mix, light rail is the worst possible choice. While there may be some differences in each case, the record of light rail transit should not be a source of optimism regarding the future of public transit. The cities that have light rail transit collectively spend over $2 billion dollars per year on capital and operating expenses. In the aggregate, this amounts to over six dollars per passenger trip. Since the average passenger trip is around four miles, the cost per passenger mile is around $1.48.[31] These costs compare unfavorably with other modes of transportation. The average cost per bus

[31] *2003 Public Transportation Fact Book* (American Public Transportation Association), Tables 48, 61, & 6.

passenger mile is around 78 cents.[32] The average cost per vehicle mile of automobile transportation is around 29 cents.[33]

Light rail's inefficiency isn't offset by effectiveness. Light rail is touted as a means of reducing urban traffic congestion. The claim is that it will lure drivers out of their cars and, thereby, reduce traffic congestion. The low actual ridership attained by light rail transit systems overstates their impact on traffic congestion and air pollution. New rail lines are typically constructed along routes where bus ridership is already heavy. Since the advocates of rail transit want the best possible ridership results, this selection of routes certainly makes sense. However, it also means that a significant proportion of the rail transit riders will have been former bus riders. In Los Angeles, it is estimated that only 10% to 15% of the riders on the newly constructed rail lines are attracted from automobiles. The remaining 85% to 90% were formerly bus riders.[34] This phenomenon is not unique to Los Angeles. It is common wherever new rail lines are implemented.[35] Consequently, the actual impact of introducing new rail transit service into a community will be far smaller than it might appear from both the ridership forecasts and actual passenger trips involving the rail line. Even counting former bus passengers, though, light rail carries less than three-tenths of one-percent of the person-miles of travel in the cities where it operates.

[32] *2003 Public Transportation Fact Book* (American Public Transportation Association), Tables 48, 61, & 6.
[33] The American Dream Coalition, Bandon, Oregon 97411, ph. 541-347-1517, http://americandreamcoalition.org/transportcosts.xls (accessed October 20, 2003).
[34] Peter Gordon and Harry Richardson, *The Facts About Gridlock in Southern California* (Reason Foundation, August 1993).
[35] *Public Works Infrastructure: Policy Considerations for the 1980s* (Congressional Budget Office, April 1983), p. 48.

Table 6: 2000 Light Rail Performance Statistics									
City	*Financial Data*					*Passenger Travel*			
	$ in millions			*passenger share*	*cost/ passenger*	*in millions*		*mi/ trip*	*% of travel*
	passenger revenue	*total outlays*	*net profit (loss)*			*miles*	*trips*		
Baltimore	$9.5	$55.4	($45.8)	17%	$6.52	59.2	8.5	7.0	0.3%
Boston	$23.6	$147.3	($123.8)	16%	$2.00	157.9	73.5	2.1	0.7%
Buffalo	$3.9	$16.2	($12.3)	24%	$2.47	15.4	6.6	2.4	0.2%
Cleveland	$3.7	$26.1	($22.4)	14%	$6.04	24.9	4.3	5.8	0.2%
Dallas	$7.2	$296.1	($288.9)	2%	$25.90	60.2	11.4	5.3	0.1%
Denver	$3.5	$61.9	($58.4)	6%	$9.27	28.2	6.7	4.2	0.2%
Los Angeles	$31.4	$64.1	($32.7)	49%	$2.15	208.8	29.9	7.0	0.2%
New Orleans	$3.3	$7.4	($4.1)	44%	$1.38	13.2	5.4	2.5	0.2%
Philadelphia	$13.0	$53.5	($40.5)	24%	$2.14	61.5	25.0	2.5	0.2%
Pittsburgh	$6.0	$65.2	($59.3)	9%	$8.87	33.2	7.4	4.5	0.2%
Portland	$18.5	$152.9	($134.3)	12%	$6.27	140.9	24.4	5.8	1.2%
Sacramento	$7.1	$74.4	($67.3)	10%	$8.62	45.9	8.6	5.3	0.4%
Salt Lake City	$5.5	$51.0	($45.5)	11%	$8.31	49.7	6.1	8.1	0.7%
San Diego	$20.9	$66.9	($46.0)	31%	$2.33	188.3	28.7	6.6	0.8%
San Francisco	$25.0	$186.3	($161.2)	13%	$4.48	108.8	41.6	2.6	0.3%
San Jose	$5.6	$155.9	($150.3)	4%	$19.70	35.8	7.9	4.5	0.3%
St. Louis	$12.2	$124.1	($111.9)	10%	$8.76	95.3	14.2	6.7	0.4%
Totals	$200.0	$1,604.7	($1,404.7)	12%	$5.17	1327.2	310.2	4.3	0.3%
Sources: *Transit Profiles for the 2000 National Transit Database Report Year* (Federal Transit Administration) and *Highway Statistics 2000* (Federal Highway Administration).									

Unfair Subsidies

Faced with the abysmal record of public transit, many of its advocates resort to claims that inequitable public policies favoring the automobile are the primary culprit. In absolute dollar terms, the amount of public sector expenditures on roads is substantially larger than for public transit. For 2001, we find government, at all levels, spending nearly $130 billion on roads.[36] During this same year, we find government, at all levels, spending about $40 billion on public transit.[37] Public sector spending on roads is over three times as large as its spending on transit. The ratio of spending may be three to one in favor of roads, but the ratio of use is far higher. In 2001, there were over 4 trillion person-miles of travel.[38] For this same year, there were 49 billion passenger-miles of travel on public transit.[39] So, of government expenditures on roads and transit combined, transit receives about 23 percent of the outlays, but provides barely 1.2% of the total

[36] *Highway Statistics 2001* (Federal Highway Administration), p. IV-9.
[37] *2003 Public Transportation Fact Book* (American Public Transit Association), pp. 87 & 99.
[38] *2001 National Household Transportation Survey* (http://nhts.ornl.gov/2001/html_files/trends_ver6.shtml accessed October 21, 2003). This figure does not include credit for the use of roads to move freight--another considerable benefit that would appear to merit a share of the public expenditures on transportation.
[39] *2003 Public Transportation Fact Book* (American Public Transit Association), p. 32.

person-miles of travel. On a total government outlay basis, public transit appears to be the recipient of far more than a fair share.

Beyond the issue of total outlays is that of the source of the outlays. As we have seen, the beneficiaries of public transit pay only about 22 percent of the cost of their trips.[40] Highway users, on the other hand, pay about 65 percent of the amount governments spend on roads.[41] This figure for highway users does not include taxes levied on vehicle owners that are deposited in "general funds" at the state and local levels. For example, the sales taxes paid for the purchase of autos and auto supplies go into state and local general funds. In addition, some states (Arizona included) levy taxes on the value of autos. Only a portion of this tax goes into highway users funds, the rest goes into the general funds. When these other taxes assessed on autos are considered, it appears that road users pay over 100 percent of the cost of roads.[42] Public transit systems are not similarly burdened with these types of taxes. Once again the equity issue seems to indicate that transit is disproportionately favored when it comes to public policy.

Refuted on the financial cost issue, many transit advocates turn to claims that on a total "social cost" basis, transit is more cost effective. The idea is that once we include the "externalities" (these are the costs imposed on the rest of society, for example: traffic congestion and air pollution) arising from the use of autos and transit, it would be shown that transit is the better overall choice. Unfortunately for transit proponents, this hope also appears doomed to unfavorable comparisons. An analysis of costs and subsidies by mode of travel in urban regions conducted by the Natural Resource Defense Council (no fan of the automobile) shows transit receiving greater subsidies when all costs, including externalities are considered.[43] When we combine all costs, we find that, once again, transit is the option favored with larger subsidies (see Table 7: Natural Resource Defense Council Estimates of Costs & Subsidies).

Table 7: Natural Resource Defense Council Estimates of Costs & Subsidies
(cents/person-mile)

Costs	**Auto**	**Bus**	**Rail**
Facilities & Services	3.1-3.7	50.1	44.1
Externalities	10.2-19.2	2.5-7.4	2.7-7.1
User Payments	.7	14	14
Net Subsidy	***12.6-22.2***	***38.6-43.5***	***32.8-38.2***

Source: Jose Gomez-Ibanez, *Pitfalls in Estimating Whether Transport Users Pay Their Way* (Kennedy School of Government, Harvard University, July 1996).

[40] *2003 Public Transportation Fact Book* (American Public Transit Association), pp. 87, 99 & 105. Passenger fare divided by capital & operating costs.
[41] *Highway Statistics 2001* (Federal Highway Administration), p. IV-9.
[42] Randal O'Toole, *Ten Transit Myths*. Reason Foundation, 3415 S. Sepulveda Blvd. Suite 400, Los Angeles, CA 90034; 310-391-2245 (September 1998), Wendell Cox, *US Streets and Highways: User Fees and Subsidies: The Difference* (http://www.publicpurpose.com/pp-hwyuser$.htm accessed October 23, 2003) and Rayola Dougher, *Estimates of Annual U.S. Road User Payments vs. Annual Road Expenditures* (American Petroleum Institute, March 1995).
[43] Jose Gomez-Ibanez, *Pitfalls in Estimating Whether Transport Users Pay Their Way* (Kennedy School of Government, Harvard University, July 1996).

Environmental Impact

But isn't public transit good for the environment? Given the higher carrying capacity per bus or train, it would certainly seem that transit could provide some environmental benefits. The problem is the gap between theoretical capacity and actual ridership. Public transit is so inconvenient and unattractive that its actual ridership falls far short of its theoretical capacity. The average load factor for transit in the year 2001 was 14 percent.[44] As a result, the energy efficiency of public transit doesn't seem to be any better than driving a car (see Table 8: Energy Efficiency by Mode).

Table 8: Energy Efficiency by Mode

Mode	*BTU/Person-Mile**	*BTU/Person-Mile***
Automobile	3,598	4,096
Transit Bus	3,415	4,143
Light Rail	3,585	5,278

Sources:
*David Shen and Jer-Wei Wu, *Commuter Rail: State-of-the-Art* (Federal Transit Administration, December 1992).
**Wendell Cox, *et al*., *The Livable American City: Toward an Environmentally Friendly Dream* (American Legislative Exchange Council, August 1993).

If transit doesn't save energy, it can't make much of a contribution to the reduction of urban air pollution. While many are under the impression that urban air quality has been getting worse, objective measures show improvements over the last two decades. In terms of ambient air pollutants, carbon monoxide has dropped by about 67 percent since 1976, nitrogen oxides have decreased by about 38%, ozone has decreased by about 28%, and particulates have decreased by about 26%.[45] On a per vehicle mile of travel basis, automobiles emit 93% less hydrocarbons, 83% less nitrous oxides, and 89% less carbon monoxide since 1967.[46] The improvement made in air quality over the last two decades owes little to public transit. Public transit ridership has increased by only 18% since 1967.[47] During this same time period, the U.S. Population has increased by about 44%.[48] Public transit hasn't even kept pace with population growth. It is serving a small share of the population than it was 35 years ago—despite the huge investment of public funds to increase the quantity of transit operations. The credit for any improvements in air quality must go to improvements made in automobiles and the fuels they use. With fleet turnover and existing employed technology, urban air should continue to improve despite an expected increase in vehicle-miles of travel.[49] New "cold start" emissions devices may reduce vehicle emissions by another 70 percent below the levels projected under existing technology.[50]

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[44] *2003 Public Transportation Fact Book* (American Public Transit Association), pp. 32 &41.
[45] Steven Hayward, *et al. Index of Leading Environmental Indicators 2001* (Pacific Research Institute, http://www.pacificresearch.org/pub/sab/enviro/01_enviroindex/Env_index01.pdf accessed October 21, 2003), p. 18.
[46] *Transportation Air Quality Fact Book* (Office of Program Development, Federal Highway Administration, http://www.fhwa.dot.gov/environment/aqfactbk/factbk14.htm accessed October 21, 2003).
[47] *Public Transportation Fact Book* (American Public Transit Association, various years).
[48] *Economagic.com: Economic Time Series Page* (http://www.economagic.com/em-cgi/data.exe/fedstl/pop accessed October 21, 2003).
[49] Joseph Bast, *et al., Eco-Sanity* (Lanham Maryland: Madison Books, 1994), p. 13.
[50] "1996 Discover Awards: Automotive and Transportation," *Discover* (July 1996).

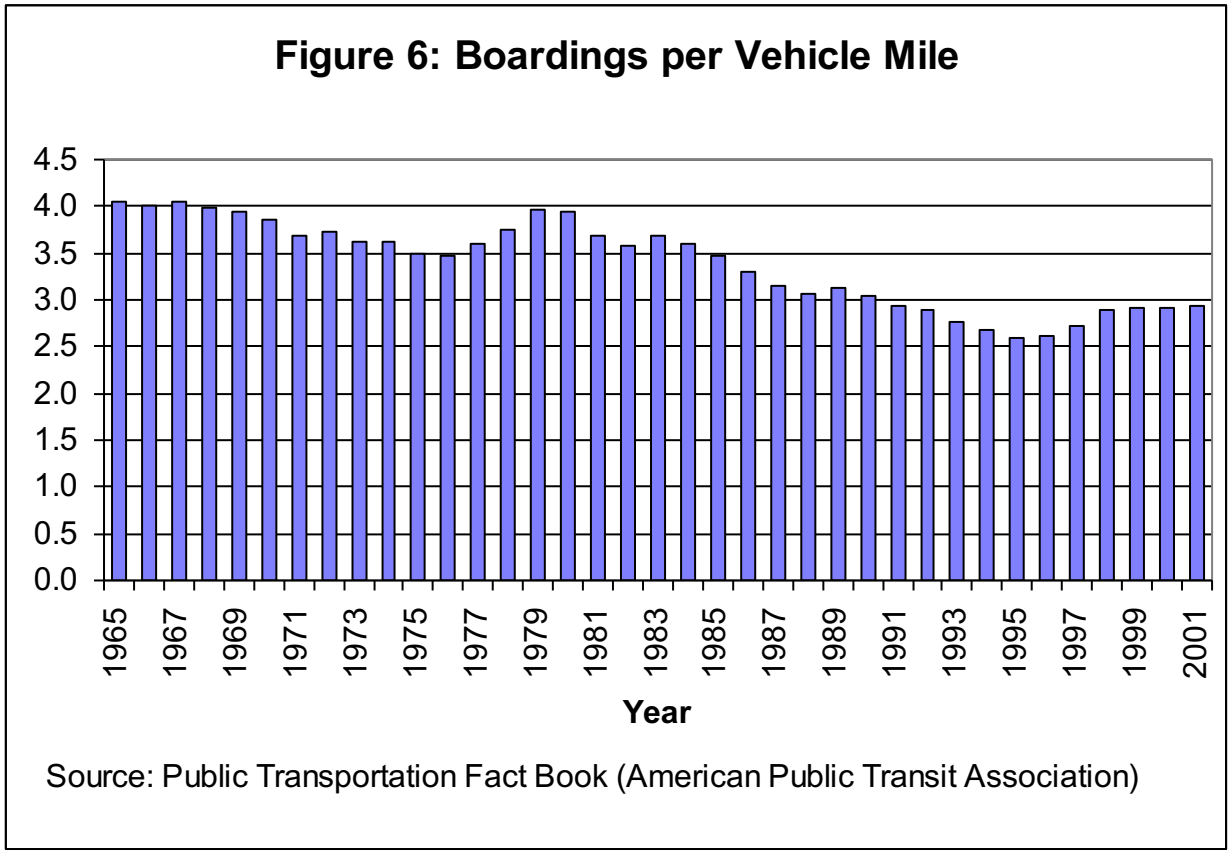
Expanding Service to Tap Latent Demand

Many transit advocates contend that ridership would be greatly expanded if hours or locations served could be expanded. In this argument it is usually conceded that public transit is inconvenient and uncompetitive...*as currently structured*. Would-be transit passengers are deterred by the lack of service to selected areas of the city or by the lack of service at selected times. It is argued that if transit service were expanded these would-be passengers would use transit. This argument is not without plausibility. It is theoretically possible that an unserved latent demand for public transit is out there waiting for the proper threshold of transit service before venturing onto a bus or train.

Unfortunately, for this theory, though, actual expansions of transit service have been followed by decreasing passenger load factors. Since 1965, the quantity of transit service has been increased. Bus-miles of service rose from 1500 million to around 2400 million in 2001. Heavy rail vehicle-miles of service rose from under 400 million to over 600 million. Light rail vehicle-miles of service were around 40 million in 1965 and around 54 million in 2001.[51] The total increase in transit carrying capacity was 55% over this time period. If adding more service were the key to improving the performance of public transit, we should have seen the number of passengers increase by a percentage larger than the percentage increase in vehicle-miles of service. We did not. In 1965, there were 8.3 billion passenger journeys on these transit modes. In 2001 there were 9.6 billion passenger journeys.[52] This is an increase of less than 20%. The theory that adding more public transit service would stimulate demand has not been borne out by the evidence.

The evidence supports a contrary theory. Namely, the public transit that already exists is serving the highest demand segments of its potential market. Expansion of service to other times and locations will inevitably be aimed at market segments with lower inherent demand for transit. Consequently, it would be hypothesized that the number of passengers per vehicle-mile would decline as transit service is expanded. This is, in fact, what has happened. In 1965, there were 4.0 passengers per vehicle-mile. By 2001, passengers per vehicle-mile had fallen below 3.0.[53] Cities contemplating expanding public transit services should not do so under the expectation that the gain in riders will exceed the increase in quantity of service. It most likely will not. Transit expansions will more likely produce dwindling load factors, more empty seats per mile, and increasing costs per passenger served.

[51] *Transit Fact Book* (American Public Transit Association, 1978-79), p.30 and *2003 Public Transportation Fact Book* (American Public Transit Association), p.41.
[52] *Public Transportation Fact Book* (American Public Transit Association, various years).
[53] Calculated from the *Public Transportation Fact Book* (American Public Transit Association, various years).



Transit Safety

Everyone knows that automobile travel is dangerous. This naturally leads to the assumption that public transit ought to be encouraged as a means of improving travel safety. However, the issue is more complex than this simple assumption allows. In some respects, introducing more transit vehicles into the mix of traffic will increase the risk.

A recently published study of light rail transit crashes for a selected sample of cities indicates that light rail trains are dangerous additions to urban traffic streams.[54] The statistics based on data as of 1996 show that with only one exception, crashes per vehicle mile of travel were reported as far higher for light rail transit than they are for motor vehicles. Data for the nine light rail systems in U.S. cities featured in the report showed an average crash rate of 1,125 per 100 million vehicle miles of travel. This is four times higher than the 276 crashes per 100 million vehicle miles for motor vehicles.

[54] Hans W. Korve, *et al. Light Rail Service: Pedestrian and Vehicular Safety, TCRP Report 69* (Transportation Research Board, 2101 Constitution Avenue, N.W., Washington, D.C. 20418; ph. 202-334-2934; http://www.national-academies.org/trb/bookstore).

Table 9: Crashes/100 Million Vehicle Miles of Travel	
LRT System	*Rate*
Baltimore	1,351
Dallas	1,514
Denver	6,471
Los Angeles	1,222
Portland	1,356
Sacramento	1,144
St. Louis	20
San Diego	676
San Jose	1,349
Average	1,125
U.S. Highway System	276

Crash rates are calculated using crash data from Table S-2 and VMT data from *1996 Transit Profiles* (FTA). The highway data is obtained from *Highway Statistics 1996* (FHWA) and *1996 Traffic Crashes, Injuries, and Fatalities* (NHTSA).

Factors leading to crashes that were cited in *TCRP Report 69* included:

- Motorists drive around lowered gates.
- Motorists disregard regulatory signs at light rail crossings.
- Motor vehicles often block the light rail tracks.
- Motorists are confused when both light rail and traffic signals are used at the same location.
- Motorists become confused about gates rising and lowering.
- Pedestrians dart across light rail tracks without looking both ways.
- Pedestrians ignore warning signs.
- Pedestrians trespass along the light rail right-of-way.
- Pedestrians do not cross the track at designated locations.
- Crossing users and light rail vehicle operators are unable to see each other.
- Automatic gates descend behind stopped motorists trapping them on the tracks.
- Light rail vehicle operators are unable to confirm that flashing light signals and automatic gates are functioning properly.

As we can see, motorist and pedestrian unfamiliarity with light rail transit may be a significant factor leading to crashes. Metropolitan regions embarking upon ventures into light rail transit need to give attention to safety a place high on the planning agenda. Like any other high accident location, light rail transit merits added scrutiny and effort to reduce the risk of crashes.

Now, the crashes of transit vehicles generally entail little risk for passengers. Travel as a passenger on public transportation is far safer than travel by private cars. The fatality risk for a

person traveling in a car is almost 20 times higher than that for a person traveling in a bus.[55] The large size and weight of the bus make its occupants more likely to survive collisions with smaller, lighter vehicles. Passengers traveling in rail transit vehicles, which are even larger and heavier than buses probably face a similarly low risk.

However, the on-board risk is not the only safety issue of concern. Pedestrians face risks prior to boarding transit vehicles. Further, rail transit vehicles operating on rights-of-way that intersect streets—as is the case for most light rail systems—may collide with persons, vehicles, or objects that come into the path of the transit trains.

As it turns out, light rail has severe safety deficiencies when compared to other modes of urban travel. The aggregate fatality rate for auto travel is around 15 persons per billion vehicle miles of travel. However, this includes rural travel, where the fatality rate per billion vehicle miles is 23. The nationwide fatality rate per billion vehicle miles of urban automobile travel is less than 10. Thus, we find that light rail's 16 fatalities per billion passenger miles of travel rate is actually higher than the rate for privately operated automobiles.[56] Consequently, the notion that luring some automobile users to switch to light rail travel will improve safety is not supported by the crash data.

Because light rail trains are frequently operated in the street, the more relevant fatality statistic for auto drivers and pedestrians to consider is the per vehicle-mile fatality rate. Light rail's fatality rate of 307 per billion vehicle miles of travel makes light rail trains extraordinarily dangerous to be near. In fact, the non-occupant fatality rate for light rail is more than ten times larger than it is for heavy trucks.[57] Even this isn't the full measure of the hazards of light rail systems built into city street medians. Persons darting into traffic in an attempt to reach a light rail train before it leaves and who are hit by cars or trucks won't be counted in the transit crash statistics. Yet, these accidents and fatalities would not occur without the existence of light rail transit stations in the middle of streets. Consequently, many cities' decisions to replace bus transit with light rail transit are very likely decisions that increase the hazards of travel all along the light rail lines.

Table 10: Urban Travel Fatality Rates by Mode for 2001

	Bus	Commuter Rail	Heavy Rail	Light Rail	Urban Auto
Vehicle Mile Rate*	50	315	42	307	10
Passenger Mile Rate**	5	8	2	11	9

*fatalities per billion vehicle miles; **fatalities per billion passenger miles

Sources: *2003 Public Transportation Fact Book* (American Public Transportation Association), Tables 18, 6, & 40 and *Highway Statistics 2001* (Federal Highway Administration), Table VM-1 & FI-10.

[55] *2002 Public Transportation Fact Book* (American Public Transportation Association), Table 75.

[56] These figures are calculated from data appearing in the following sources: *2002 Public Transportation Fact Book* (American Public Transportation Association), Tables 30, 42 & 71 and *Highway Statistics 2000* (Federal Highway Administration), Table VM-1 & FI-10.

[57] *Traffic Safety Facts 2001* (National Highway Traffic Safety Administration), Tables 36 and 74, *2003 Public Transportation Fact Book* (American Public Transportation Association), Tables 18, 6, & 40 and *Highway Statistics 2001* (Federal Highway Administration), Tables VM-1 & FI-10.

Transit Crime

Traffic crashes are not the only safety issue of concern in public transportation. Crime is also a matter that must be considered in evaluating decisions to implement transit systems. Light rail proponents, for example, have repeatedly emphasized the potential for light rail stations to attract real estate development. This may well be true, but it is not an unmixed blessing. Light rail also appears to attract an unusually high number of criminals. Compared to other transit modes, light rail has the worst crime rate. Light rail's violent crimes against persons (i.e., murder, rape, robbery and assault) rate of 284 per billion passenger miles of travel is nearly three times higher than the rate for bus transit. Light rail's crimes against property (larceny, theft, burglary and arson) rate of 779 per billion passenger miles of travel is six times higher than the rate for bus transit. A decision to replace bus transit with light rail transit is very likely a decision that will bring more crime to the area.

Table 11: 2001 Public Transit Serious Crime Statistics

	Murder/Rape/ Robbery/Assault		Larceny/Theft/ Burglary/Arson		Combined	
	Total	Rate*	Total	Rate*	Total	Rate*
Bus	2,114	97	3,171	144	5,285	240
Commuter Rail	260	27	2,508	263	2,768	290
Demand Response	13	15	13	15	26	30
Heavy Rail	2,765	195	9,084	641	11,849	836
Light Rail	408	284	1,120	779	1,528	1,063

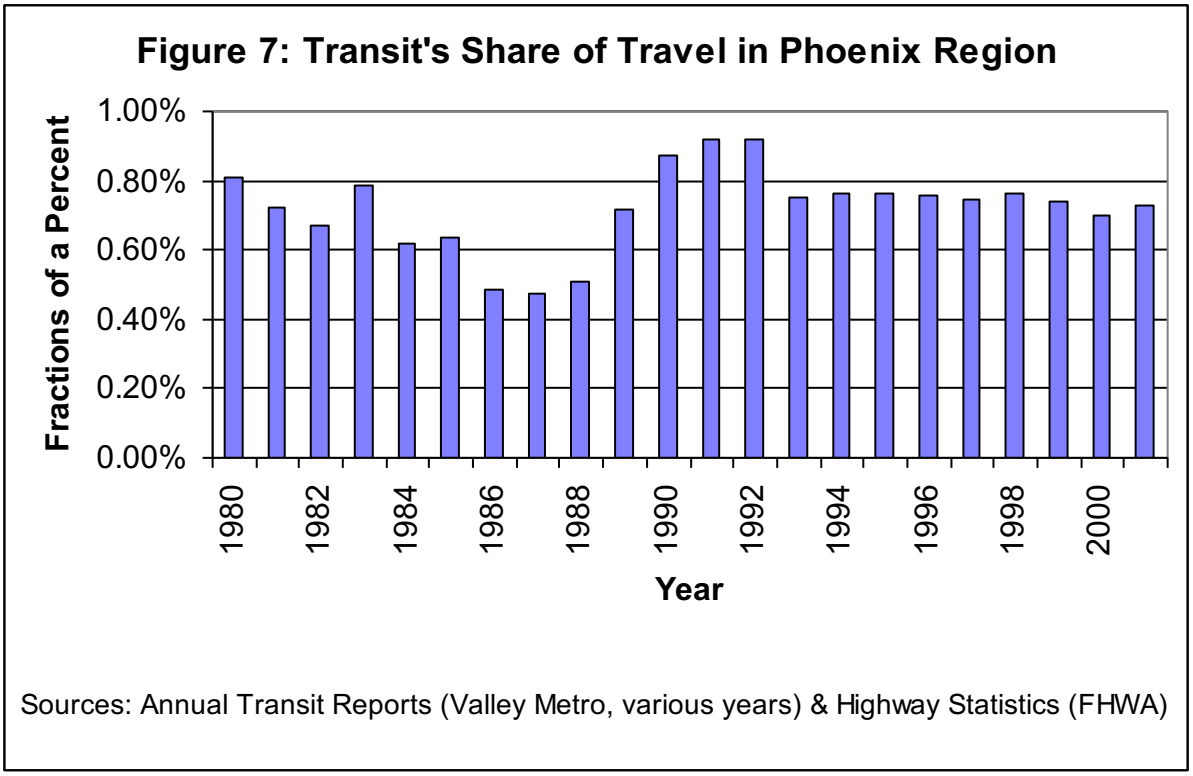
*per billion passenger miles

Source: *2003 Public Transportation Fact Book* (American Public Transportation Association), Tables 6 & 45.

PHOENIX PERSPECTIVE

Transit's Share of Local Travel

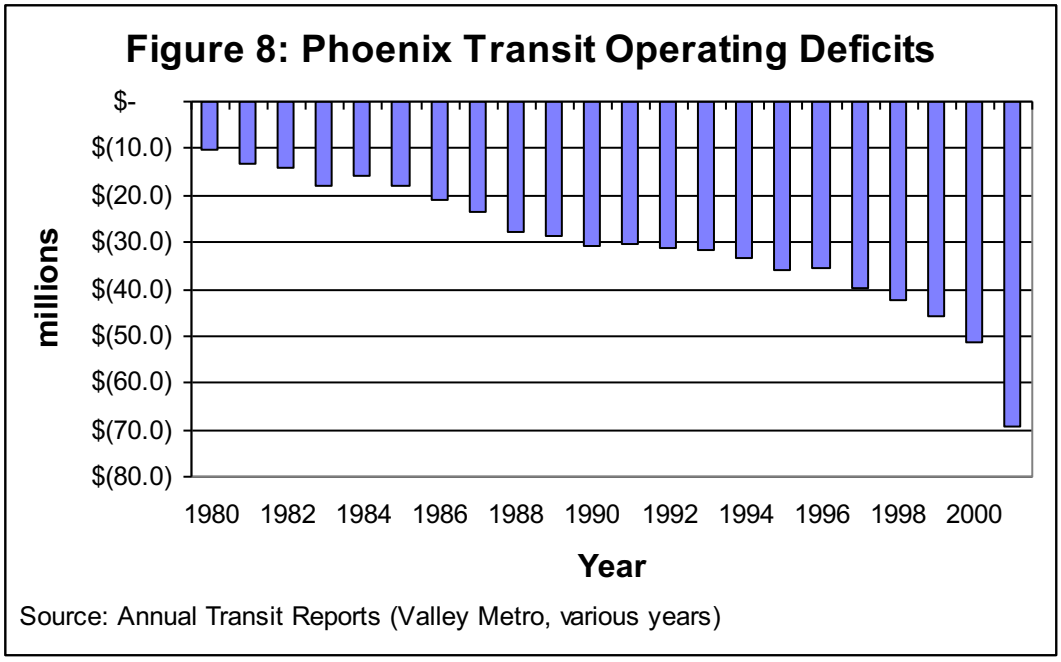
Although, long term statistics are not as readily available for Phoenix's transit system as they are for the nation as a whole, it is still clear that transit's share of travel in the Phoenix metropolitan region, while not in as precipitous a decline as in the rest of the nation, is not growing. Data from the last 20 years indicate that transit's share has never reached even 1 percent of the total travel. It has fluctuated between 5/10ths and 9/10ths of 1 percent for this entire period (see Figure 7: Transit's Share of Travel in Phoenix Region). Rising family income and the relative inconvenience of transit for most trips work against the system's achieving a growing share of the travel.



Endless Deficits

The financial performance of Phoenix transit shows a pattern of rising deficits over the last decade (see Figure 8: Phoenix Transit Operating Deficits). As we can see, the system has consistently lost money. Deficits have risen by nearly 600 percent over the last 20 years. The cumulative loss on an operating basis for this 20-year period is in excess of $600 million.[58] It must be noted that the operating statements produced by Phoenix Transit significantly understate the losses suffered by the agency. The reason for this is that capital costs are excluded. That is, the costs of buying buses, building facilities, and borrowing money to finance these items are not counted as operating expenses. This bizarre accounting practice is common in the transit industry. It would be tantamount to a trucking company excluding the cost of buying trucks, building freight terminals, and borrowing money to run the business from its operating statements. While various rationalizations are offered for this practice (for example: "it's standard in the industry" and "it follows from the fact that federal aid is separated into capital and operating grants"), the real explanation probably lies in the fact that a full and open disclosure of financial data in an easily comprehensible format would too readily reveal the wretchedness of the results.

[58] Valley Metro, (302 N. 1st Ave., Suite 700, Phoenix, AZ 85003; ph. 602-262-7242).



Planned Transit Expansion

Bad as the financial results of the existing Phoenix bus service are, government officials are not shy about pushing expansions of transit service. Valley Metro is in the initial stages of implementing a 20-mile light rail system at an estimated cost of around $50 million per mile. The document[59] submitted in support of Valley Metro's application for federal transit aid to the proposed light rail system provides a lot of interesting data that could be used to estimate the traffic and environmental impacts of the proposed transit system.

The capital cost of the 20-mile light rail system is projected at about $1.0 billion. The projected cost per rider is over $12.[60] The fare revenue per rider is projected to be less than 70 cents.[61] The share of the costs paid by riders is projected at 5% for light rail. Taxpayers would pay the other 95%.[62]

Although not a single mile of the new light rail track has been laid, Valley Metro is already proposing a 30+ mile expansion of the light rail system. This proposed expansion is part of the Maricopa Association of Governments (MAG) Transportation Plan that is expected to be submitted to voters sometime during 2004.[63] The plan calls for a one-half cent tax to be imposed for 20 years in order to fund a combination of roadway and transit outlays.

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[59] *Central Phoenix/East Valley Light Rail Project, FY 2004 Section 5309 Annual Report on New Starts* (Valley Metro, 302 N. First Avenue, Suite 700, Phoenix, Arizona 85003; ph. 602-262-7242; http://www.valleymetro.org) (August 2002)

[60] *Central Phoenix/East Valley Light Rail Project, FY 2004 Section 5309 Annual Report on New Starts*, p. V-3.

[61] *Central Phoenix/East Valley Light Rail Project, FY 2004 Section 5309 Annual Report on New Starts*, annualized light rail fare revenue of $5.2 million divided by annualized light rail ridership of 7.9 million.

[62] *Central Phoenix/East Valley Light Rail Project, FY 2004 Section 5309 Annual Report on New Starts*, annualized light rail fare revenue of $5.2 million divided by annualized light rail costs of 97.8 million.

[63] *Regional Transportation Plan* (Maricopa Association of Governments, 302 North 1st Avenue, Suite 300, Phoenix, Arizona 85003; Phone (602) 254-6300) (2003).

One way of evaluating alternative uses of investment funds is to compare the returns on investment. When we are faced with different types of investment options—highways vs. light rail, for example—we need a common denominator. Since the main objective of the Maricopa Association of Governments' plan is to provide transportation for people, the obvious common denominator is the person-mile of travel. That is, what would it cost to transport one person one mile via the various alternatives.

Costs include both capital and operating expenses over a 20 year time period. Ridership for transit and vehicle miles of travel for automobiles are projected over the same 20 year period. Costs can be further broken out into those financed through taxes and those financed through payments made by users (fares in the case of transit riders, vehicle ownership & operating costs for automobile drivers).

Based on data from MAG and Valley Metro, the accompanying table has been compiled. From the government's perspective, the cost of providing transportation through these different alternatives is significantly lower if roads are built than if transit systems are constructed and operated. The average cost to the taxpayer for providing a person-mile of service is around six cents for freeways and five cents for arterial streets. This is considerably less than the $1.59 and $2.75 costs per person-mile than for buses and light rail, respectively. In contrast, the cost per person-mile of travel from expenditures on roadway expansion is around six cents.[64]

In terms of the proposed sales taxes to be invested, the average cost of providing a person-mile of service is around three cents for both freeways and arterial streets. This is considerably less than the $0.47 and $1.18 costs per person-mile for buses and light rail, respectively.

Since the government provides a much larger subsidy to the transit user a person who rides the bus is projected to pay about 28 cents per person-mile of travel, while the light rail rider would pay about 15 cents per person-mile. Meanwhile, the cost of owning and operating an automobile averages about 29 cents per vehicle mile.[65] So, from a personal cash-expense standpoint, it is less costly for an individual to use transit than to own and operate a car. That more people do not use transit is probably due to its inconvenience. Average travel speeds for buses in the Phoenix metropolitan region are in the 14 mph range. The advertised travel speed for the light rail is in the 20 mph range[66] (although, the national average speed for light rail is 15.1 miles per hour).[67] These speeds do not include waiting times or the time it takes to get from one's home to the bus stop or trolley station.

When all costs are considered, both tax cost and personal cost, the highway-automobile combination is the least costly option. The highway-automobile combination costs around 35 cents per person-mile of travel. At $1.87 per person-mile, bus transit is five times as costly. At $2.90 per person-mile, light rail transit is over eight times as expensive. In terms of obtaining the most benefit at the least total cost to society, the highway-automobile combination is the better investment.

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[64] Wendell Cox found an even lower cost per added person-mile of travel (2 cents) for roadways (http://www.publicpurpose.com/ut-tr$fr1970.pdf, accessed October 28, 2003)

[65] The American Dream Coalition, Bandon, Oregon 97411, ph. 541-347-1517, http://americandreamcoalition.org/transportcosts.xls (accessed October 20, 2003).

[66] *Frequently Asked Questions* (Valley Metro), p. 2. http://www.valleyconnections.com/content_04/index.cfm (accessed October 28, 2003).

[67] *2003 Public Transportation Fact Book* (American Public Transportation Association), p. 43.

Table 12: Cost Per Person-Mile of Travel Under MAG Plan				
	Sales Tax	*Other Taxes*	*Private Costs/Fares*	*Total*
Phoenix Region Data				
Freeways	$ 0.03	$ 0.03	$ 0.29	$ 0.35
Arterial Streets	$ 0.03	$ 0.02	$ 0.29	$ 0.34
Light Rail	$ 1.18	$ 1.57	$ 0.15	$ 2.90
Buses	$ 0.47	$ 1.12	$ 0.28	$ 1.87
National Data				
Roads	NA	$ 0.05	$ 0.29	$ 0.34
Buses	NA	$ 0.58	$ 0.20	$ 0.78
Light Rail	NA	$ 1.34	$ 0.14	$ 1.48
Sources: *Regional Transportation Plan* (MAG), *Central Phoenix/East Valley Light Rail Project* (Valley Metro) and The American Dream Coalition, http://americandreamcoalition.org/transportcosts.xls (accessed October 20, 2003), *2001 Highway Statistics* (Federal Highway Administration), tables HF-10 & VM-1, *2003 Public Transportation Fact Book* (American Public Transportation Association, tables 6, 48, 61 & 64.				

Of course, not all highway investments are equally good. For example, the proposed double-decking of I-17 costs about twice as much in taxes per person-mile as the rest of the proposed roadways.[68] Nevertheless, even the worst roadway investment is a far less costly method, from both a taxpayer's perspective and a total cost perspective, for providing person-miles of transportation. And this does not include the substantial benefits of freight movement that roads provide, but transit does not.

Valley Metro's estimated cost per passenger trip for the light rail is $12.39. Using Valley Metro's figure, what this means is that it will cost $24.78 per passenger, per day for a round trip commute to work on light rail (more if a bus connection must be included). This adds up to over $6,000 per year per passenger. Of this amount, the passenger would pay about $300. The taxpayers would be compelled to pay the other $5,700.

When we consider that the regional share of travel for all transit modes is about 1% of the total person-miles of travel, spending 30% of the regional tax revenue on transit appears grossly inequitable. Under the MAG Transportation Plan for every dollar spent to benefit automobile drivers $40 would be spent to benefit transit riders.

How can it possibly be equitable to spend forty times as much for the benefit of transit riders as would be spent for the 99% of the population who travel by car? Shouldn't all taxpayers—drivers and transit riders alike—receive roughly equal treatment when it comes to spending their money?

Every government document on the performance of transit confirms that it is a bad investment. The service provided is inconvenient. The impact on traffic is debatable. The cost is far higher than the alternative of building better roads. If we want to get the best return on our investment in transportation the clear choice is to build roads. Yet, we see MAG preparing to hold the prospect of improved roads hostage to the squandering of tax dollars on an ill-conceived transit boondoggle. MAG is inviting the legislature and voters to reject the whole package.

Confronted with the miniscule impact of light rail on a regional basis, its defenders have taken to comparing its prospective impacts on traffic with freeway facilities like the Squaw Peak. Unfortunately, for the light rail advocates, a corridor-to-corridor comparison between the

[68] *Regional Transportation Plan* (Maricopa Association of Governments, 302 North 1st Avenue, Suite 300, Phoenix, Arizona 85003; Phone (602) 254-6300) (2003).

primary light rail line and the Squaw Peak Freeway does not do much to bolster the case for rail. The Squaw Peak Freeway averages 130,000 vehicles per mile per day. The prospective light rail line would average little more than 4,000 passengers per mile per day.[69] Mile for mile, the Squaw Peak Freeway serves over 30 times more travel demand than a light rail line that would be placed in an optimal corridor would. Whether the perspective is regional or corridor-by-corridor, light rail is clearly an inferior option when it comes to serving the travel needs of the Phoenix metropolitan region.

Light Rail vs. Bus Rapid Transit

The decision to build a light rail system in the Phoenix region has been reached, purportedly, after the evaluation of alternatives. In terms of the cost per person served, though, it appears obvious that light rail is the least cost-effective alternative that could have been chosen. On average, light rail is projected to cost over $12 per passenger boarding while bus service is projected to cost $7 per passenger boarding.[70] The Maricopa Association of Governments went a step further to calculate the comparative cost of providing service in selected corridors by light rail (LRT) vs. bus rapid transit (BRT). Bus rapid transit service is characterized by few stops and long routes. Typically, passengers would be picked up at a few locations clustered in a suburban community. The bus would then travel non-stop to downtown Phoenix and passengers would be dropped off at a few locations in the center of the city.

As we can see from the table below, in every single instance it would be less expensive to provide the service via BRT than via LRT. Given this comparison how can a rational decision maker, steward of the public treasury, or representative of the people possibly choose light rail? Why should taxpayers be required to buy the higher-priced light rail service when a less expensive, and higher quality (BRT's fewer stops offer a shorter transit time than LRT which makes stops every mile or so along the corridor) option is available? Transit officials and rail advocates offer no coherent explanation.

[69] This is in line with typical freeway/light rail comparisons. Wendell Cox finds that On average new US light rail lines carry 80 percent less volume than a single freeway lane couplet (2 lanes of freeway, one operating in each direction). http://www.publicpurpose.com/ut-fwy&lrt.htm (accessed October 28, 2003).

[70] *Central Phoenix/East Valley Light Rail Project, FY 2004 Section 5309 Annual Report on New Starts*, p. V-3. Bus cost is calculated by subtracting the light rail cost from the total.

Table 13: Projected Light Rail vs. Bus Rapid Transit Performance					
	Light Rail		*Bus Rapid Transit*		*LRT vs. BRT Cost/Boarding*
Route	*Annual Total Cost (millions)*	*Cost/ Boarding*	*Annual Total Cost (millions)*	*Cost/ Boarding*	
59th Ave	$70	$14.85	$40	$8.55	+$6.30
Bell Road	$111	$15.36	$66	$9.11	+$6.25
Camelback	$36	$12.00	$21	$7.04	+$4.96
Chandler Boulevard	$64	$14.44	$34	$7.67	+$6.77
Main St	$39	$10.98	$29	$8.06	+$2.92
Power Road	$45	$14.40	$39	$12.30	+$2.10
Scottsdale Rd/Tempe	$102	$13.49	$27	$3.61	+$9.88
SR-51	$80	$17.82	$58	$12.93	+$4.89
UP Chandler	$47	$10.34	$35	$7.59	+$2.75
Totals/Averages	$737	$13.25	$348	$8.17	+$5.08
Source: *High Capacity Transit Study* (Maricopa Association of Governments, 302 North 1st Avenue, Suite 300, Phoenix, Arizona 85003; http://www.mag.maricopa.gov/pdf/cms.resource/HCT-Final-Report.pdf ; Phone (602) 254-6300, 2003), Tables 9-3 & 9-4, pp. 78 & 80.					

Inequitable Subsidies

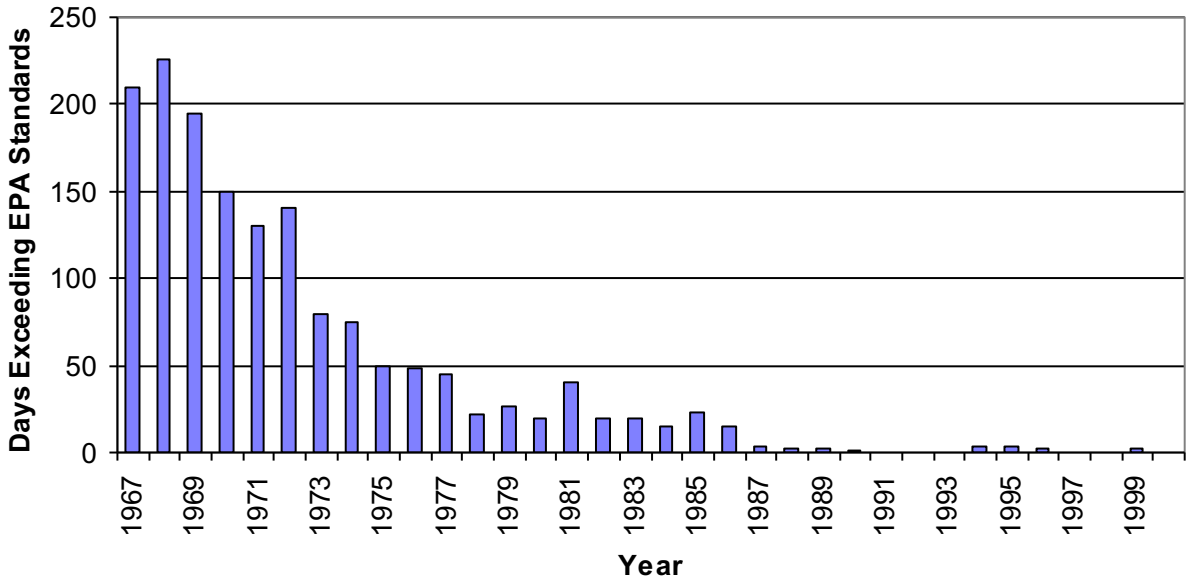
Transit proponents in Phoenix complain that transit is on the short end of tax expenditures for transportation. Spending on roads in the Phoenix metropolitan region averages around $700 million per year.[71] Spending on Phoenix Transit has been only a fifth of this amount.[72] In absolute numbers it does look as if transit is short changed. However, when we consider that transit provides less than 1 percent of the passenger transportation, its one-sixth share of total outlays seems excessive. Then, too, there is the question of who pays for these outlays. Granted, freeways in the Phoenix region are the main beneficiaries (Phoenix Transit also receives about 5 percent of this transportation sales tax revenue) of a subsidy from a county sales tax. However, this subsidy from non-users is offset by the fact that 60 percent of the vehicle license tax is used to subsidize non-highway government spending. The net result is passenger vehicle road users in Arizona pay taxes sufficient to cover the full cost of their use of the roads.[73] Transit users pay only about 20 percent of the cost of the Phoenix Transit bus service.[74] Transit users are projected to pay even less of a share of the costs (15% for bus rides and 5% for light rail rides) for any expansion of the current system, whether by adding buses or rail.[75]

[71] *Progress on the State Highway System FY 2001-2002* (Arizona Department of Transportation, November 2002), p. 5 and *2002 Arizona Transportation Fact Book* (Arizona Department of Transportation), p. 29.
[72] *Annual Short Range Transit Report Fiscal Year 2002 through 2006* (Regional Public Transportation Authority, 2002).
[73] Jason Carey, *1999 Update of the Arizona Highway Cost Allocation Study* (Arizona Department of Transportation, August 1999), p. 13 and Nadia Mansour and John Semmens, *The Value of Arizona's State Highway System: A Corporate Style Financial Analysis* (Arizona Department of Transportation, October 1999), p. 11.
[74] *Annual Short Range Transit Report Fiscal Year 2002 through 2006* (Regional Public Transportation Authority, 2002).
[75] *Central Phoenix/East Valley Light Rail Project, FY 2004 Section 5309 Annual Report on New Starts* (Valley Metro, 302 N. First Avenue, Suite 700, Phoenix, Arizona 85003; ph. 602-262-7242; http://www.valleymetro.org)

Environmental Impact

Transit's contributions to air quality both in retrospect and the future are exceedingly small. Though one would not know it from the media accounts, air quality in the Phoenix metropolitan region has improved over the last 30 years (see Figure 9: Carbon Monoxide Pollution in Central Phoenix). In 1970, there were 150 days in which the air in central Phoenix exceeded EPA carbon monoxide standards. In 2000, there were no days in which these standards were violated.[76] When apprised of this statistic many assume that the standards must have been loosened. They have not. During this whole period of air quality improvement, transit's less than 1 percent share of urban travel has had minimal impact. The big factor in Phoenix, as elsewhere, was the improvement in automobiles.[77]

Figure 9: Carbon Monoxide Pollution in Central Phoenix



Source: Maricopa County Environmental Services, http://www.maricopa.gov/envsvc/AIR/AIRDAY/co-hdata.asp (accessed October 22, 2003)

Future improvements in air quality will also have to come from some source other than expanded public transit. In 1996, two studies evaluated the probable air quality impacts of a variety of options. In terms of both magnitude of impact and cost-effectiveness, transit fared poorly when compared to other alternatives. In a report prepared for the Arizona Department of

(August 2002), Table VII-1, FY1999-2020 revenue totals divided by 21 years for combined and light rail, bus revenue calculated by subtracting light rail from combined total.

[76] Maricopa County Environmental Services Dept., Air Quality Division, 1001 N. Central Ave., Suite 200, Phoenix, AZ 85004; (602) 506-6010; http://www.maricopa.gov/envsvc/AIR/AIRDAY/co-hdata.asp (accessed October 22, 2003).

[77] Joseph Bast, *et al., Eco-Sanity* (Lanham Maryland: Madison Books, 1994), pp. 12-13.

Transportation, transit ranked near the bottom of the list in terms of cost-effectiveness in reducing air pollution. Rail transit ranked dead last, costing hundreds of thousands of dollars per ton of pollution reduction.[78] The magnitude of the impacts for transit measures was also small. Regardless of whether bus or rail is employed, the impacts are all projected to be less than 1 percent.

Transit showed similarly poor comparisons in the *Alternative Transportation System Task Force Report to Governor Fife Symington.*[79] An interesting aspect of this report to the governor is that in its "grab bag" agglomeration of recommendations produced by a desire for a "consensus" task force conclusion, diluted the core finding of the research. The core finding was that we could have a substantial impact on air pollution at a very low cost from a program that targets high emitting vehicles. Consider the following statistics from the final report. The high emitter measures' pollution reduction figure of 35,598 tons per year is 65 percent of the total projected impact of all the recommended options. The combined cost of all four high emitter options is $5 million/year, about 7 percent of the total state and local government cost of the package of recommendations. In contrast, the bus expansion's 900 tons of pollution reduction is less than 2 percent of the total projected impact. Yet, the bus option's net annual cost of $45 million is 66 percent of the total state and local government cost of the package of recommendations.[80]

Table 14: Emissions Reductions Policies Ranked by Cost-Effectiveness combines the data from the two cited reports. The inescapable conclusion is that as an environmental measure, investments in public transit have a poor ratio of benefit to cost. A lot of money would be expended for very meager results. Of course, these estimates were prepared prior to the revelation that light rail will actually increase both traffic congestion and air pollution (see next section).

[78]Matthew Rowell, *et al., The Cost Effectiveness and Magnitude of Potential Impact of Various Congestion Management Measures* (Arizona Department of Transportation, March 1997), p. 40.
[79] *Alternative Transportation System Task Force Report to Governor Fife Symington* (November 15, 1996), p. S-11.
[80] *Alternative Transportation System Task Force Report to Governor Fife Symington* (November 15, 1996), p. S-11.

Table 14: Traffic Reduction Measures Ranked by Cost-Effectiveness						
			Traffic		Air Quality	
Option	*timing of impact*	*additional cost/year (millions)*	*traffic impact*	*cost/1% (millions)*	*pollution reduction (tons/year)*	*cost/ton*
Proximate Commuting	near term	none	3.0%	none	11,000	none
4/10s Work Week	near term	none	1.4%	none	5,000	none
Jitneys	near term	none	0.5%	none	1,900	none
Flex Time	near term	none	0.3%	none	1,000	none
Privatize Buses	near term	none	0.2%	none	750	none
Guaranteed Ride Home	near term	$0.4	0.4%	$1.0	1,500	$270
Telecommuting	near term	$3.4	2.0%	$1.7	7,500	$450
HOV to HOT Lanes	near term	$4.0	2.0%	$2.0	7,500	$530
Synchronize Signals	near term	$16.0	8.0%	$2.0	30,000	$530
Congestion Pricing	near term	$20.0	10.0%	$2.0	37,000	$540
Freeway Management	near term	$17.0	2.0%	$8.5	7,500	$2,300
Complete Freeways	long term	$100.0	8.0%	$12.5	30,000	$3,300
Bus Expansion	near term	$138.0	0.8%	$172.5	3,000	$46,000
Light Rail	long term	$57.0	0.2%	$285.0	750	$76,000
Air Quality Measures Ranked by Cost-Effectiveness						
Super Emitter Measures	near term	$8.4	N/A	N/A	36,000	$230
Mobile Emissions	near term	$23.0	N/A	N/A	90,000	$260
Sources: Matthew Rowell, *et al., The Cost Effectiveness and Magnitude of Potential Impact of Various Congestion Management Measures* (Arizona Department of Transportation, March 1997) and *Alternative Transportation System Task Force Report to Governor Fife Symington* (November 15, 1996).						

Environmental Impact Statement

The unavoidably tiny potential impact of transit on air quality has not stopped transit officials and advocates from advertising it as a means for cleaning the air. With the filing of the environmental impact statement that accompanied Valley Metro's application for federal aid for its light rail start, though, came the disclosure that building trolley tracks in the streets will actually increase traffic congestion and air pollution.

On the traffic issue, building the light rail system is expected to reduce vehicle miles of travel (VMT) by about 0.04% (four-hundredths of one percent) in the region and 0.13% (thirteen-hundredths of one percent) in the corridor served by the light rail system.[81] This amounts to taking one car out of 2500 out of the traffic stream in the region and about one car in 750 out of the traffic stream in the corridor. One might think this would result in a tiny improvement in traffic congestion. However, the increase in hours that vehicles will spend in the traffic stream reveals that congestion is actually increased. Vehicles hours of travel (VHT) is expected to rise by about 0.45% (forty-five hundredths of a percent) in the region and 1.23%

[81] *Central Phoenix/East Valley Light Rail Project: Final Environmental Impact Statement*, (Valley Metro, 302 N. First Avenue, Suite 700, Phoenix, Arizona 85003; ph. 602-262-7242; http://www.valleymetro.org) (November 2002), p. S-18.

(one and twenty-three hundredths of one percent) in the corridor.[82] Obviously, the impact of the proposed light rail system is tiny. More importantly, though, is the fact that the impact is, on balance, negative.

So, while the availability of light rail will slightly reduce the miles people drive, it will also slightly increase the time it takes to drive these miles. Tearing out road lanes so rail tracks can be put into the streets reduces capacity. Vehicle traffic that previously had six lanes to use is squeezed into four. This will slow traffic. In addition, trains given traffic signal preemption rights will disrupt synchronization and increase the frequency of stop-and-go traffic. Finally, train tracks will block direct access to many driveways and side streets along the route and will bar many left turns. This will necessitate more roundabout trips for many drivers.

Table 15: Impact on Traffic			
Daily Vehicle Miles of Travel			
	No Build	*Build*	*Impact*
Region	108,258,800	108,213,200	-0.04%
Corridor	18,278,600	18,254,400	-0.13%
Daily Vehicle Hours of Travel			
	No Build	*Build*	*Impact*
Region	4,827,800	4,849,500	+0.45%
Corridor	1,018,700	1,031,200	+1.23%
Source: This is a composite of tables S-8 & S-9 in the *Central Phoenix/East Valley Light Rail Project: Final Environmental Impact Statement* (Valley Metro), p. S-18.			

When it comes to pollution, light rail proponents have always emphasized the tons of pollutants that would be removed from the air as a result of implementing a light rail system. Tons of pollution reduction sounds big. The Phoenix light rail proposal asserts that building a light rail line will reduce air pollution in the Phoenix metropolitan region by around 800 tons per year.[83] They don't bother to inform people that this amounts to only two-tenths of one-percent of the 400,000 tons annual total of air pollution in the metropolitan region.[84]

Even this tiny impact is overstated because it is based on the premise that every light rail passenger would otherwise drive a car. Most light rail riders will, of course, be former bus riders.[85] In addition, placing train tracks into the street reduces roadway capacity. This will increase traffic congestion and auto emissions. Data on page 4-51 of the Central Phoenix/East Valley Light Rail Project: Final Environmental Impact Statement prepared by Valley Metro confirms that not only are the air quality benefits of light rail overstated. They are non-existent.

There are 12 monitoring stations near the rail line for which forecasts were made by Valley Metro. In only three cases does building light rail lead to lower projected pollution readings. In one case, there is no difference. In eight cases, the no-build alternative results in

[82] *Central Phoenix/East Valley Light Rail Project: Final Environmental Impact Statement*, (Valley Metro, 302 N. First Avenue, Suite 700, Phoenix, Arizona 85003; ph. 602-262-7242; http://www.valleymetro.org) (November 2002), p. S-18.

[83] *Central Phoenix/East Valley Light Rail Project, FY 2004 Section 5309 Annual Report on New Starts* (Valley Metro, 302 N. First Avenue, Suite 700, Phoenix, Arizona 85003; ph. 602-262-7242; http://www.valleymetro.org) (August 2002), p. III-1.

[84] http://www.maricopa.gov/envsvc/AIR/AIRDAY/aqsource.ppt (accessed September 26, 2003)

[85] Peter Gordon and Harry Richardson, *The Facts About Gridlock in Southern California* (Reason Foundation, August 1993).

lower pollution. For both the one-hour and eight-hour measurement periods, the build alternative is predicted to result in higher average pollution levels.

The *Central Phoenix/East Valley Light Rail Project: Final Environmental Impact Statement* shows carbon monoxide parts per million for both the "build" and "no-build" alternatives. Carbon monoxide pollution is worse under the "build" alternative. This means that our urban region's air quality in the future will be worse if the light rail system is built than if it is not built. Though Valley Metro spokesperson Daina Mann has attempted to explain this as a purely localized phenomenon due to the park-and-ride lots near the light rail line,[86] the fact that vehicle hours of travel are projected to increase both in the corridor and the region refutes her contention. If vehicles are expending more time traveling fewer miles they will be burning more fuel and emitting more pollutants.

Pollution under both the build and no-build options will be lower in 2020 than it is today. This is due almost exclusively to improvements in automobiles. As cited elsewhere in this report, emissions from automobiles have declined dramatically over the last 30 years and are expected to continue to do so as further improvements in automobile technology are introduced.[87]

[86] Garin Goff, "Light Rail Proponents Spar with Opponents," *East Valley Tribune* (October 16, 2003), p. A5.
[87] Joseph Bast, *et al., Eco-Sanity* (Lanham Maryland: Madison Books, 1994), p. 13.

Table 16: Carbon Monoxide Parts/Million				
		Year 2020		
One Hour Levels	**Existing**	**No-Build**	**Build**	**Build vs. No-Build**
Bethany & 19 Av	7.5	6.0	6.9	+0.9
Camelback & 19 Av	7.8	6.2	7.3	+1.1
Van Buren/Grand/7 Av	6.9	6.1	6.4	+0.3
Indian School & 7 St	8.7	7.4	7.3	-0.1
McDowell & 7 St	8.7	7.7	7.5	-0.2
I-10 & 7 St	5.7	4.8	4.8	0.0
Washington & 32 St	5.7	5.1	5.4	+0.3
Apache Blvd & Rural	8.6	6.9	7.7	+0.8
Apache Blvd & McClintock	10.7	8.3	8.8	+0.5
Broadway & Dobson	10.0	9.9	7.8	-2.1
Broadway & Extension	6.1	5.4	5.7	+0.3
Apache Blvd & Price	4.9	4.2	5.5	+1.3
Average	*7.6*	*6.5*	*6.8*	*+0.3*
Eight Hour Levels	**Existing**	**No-Build**	**Build**	**Build vs. No-Build**
Bethany & 19 Av	5.3	4.2	4.8	+0.6
Camelback & 19 Av	5.5	4.3	5.1	+0.8
Van Buren/Grand/7 Av	4.8	4.3	4.5	+0.2
Indian School & 7 St	6.1	5.2	5.1	-0.1
McDowell & 7 St	6.1	5.4	5.3	-0.1
I-10 & 7 St	4.0	3.4	3.4	0.0
Washington & 32 St	4.0	3.6	3.8	+0.2
Apache Blvd & Rural	6.0	4.8	5.4	+0.6
Apache Blvd & McClintock	7.5	5.8	6.2	+0.4
Broadway & Dobson	7.0	6.9	5.5	-1.4
Broadway & Extension	4.3	3.8	4.0	+0.2
Apache Blvd & Price	3.4	2.9	3.9	+1.0
Average	*5.3*	*4.6*	*4.8*	*+0.2*

Source: *Central Phoenix/East Valley Light Rail Project: Final Environmental Impact Statement* (Valley Metro), p. 4-51.

An Unbalanced Regional Plan

Advocates of increased public expenditures for transit frequently assert the need for a "balanced" transportation system. In the Phoenix region, the ratio of public spending on roads to spending on transit is currently about 85% on roads to 15% on transit. Transit advocates see this as unbalanced in favor of roads. More, they demand, must be spent on transit. In fact, the MAG Transportation Plan calls for 32% of the regional transportation fund money to be spent on transit over the next 20 years.[88] The notion that an increased allocation of public funds to transit will produce a more balanced transportation system is wrong on every count.

Assuming that transit (buses and light rail combined) will achieve the ridership goals projected in the plan, it will account for slightly more than 1% of the person-miles of travel. By

[88] *Regional Transportation Plan* (Maricopa Association of Governments).

itself, light rail is projected to account for only 0.2% (two-tenths of one percent) of the person-miles of travel in the region over the next 20 years.[89] If 32% of the transportation sales tax is spent on transit it will mean that for every one dollar spent to benefit drivers of automobiles, $40 will be spent to benefit transit riders. The one percent who ride transit will be treated far better than the 99% who drive cars. This is an imbalance and an inequity of major proportions.

While roads serve every part of the region, transit does not. In this regard, the light rail system is particularly deficient. Eighty percent of the proposed 57 mile system is within the borders of Phoenix. Only four of the 25 jurisdictions within Maricopa County will see any light rail service. Yet, taxpayers in every corner of the county will be required to pay for it. In terms of the light rail service to be provided, taxpayers in these jurisdictions will get a zero rate of return for the money they have to pay (actually, considering the increased traffic congestion and air pollution that light rail is likely to cause, they will experience negative returns).

Public transit is not really a regional service. The average length of each trip a rider takes is only four miles. It is easy to understand why. Buses in the Phoenix region average a speed of only 14 miles per hour. Light rail is not likely to do much better. The fact that the trolleys are capable of speeds up to 55 miles per hour means little when the trolleys are operating in the middle of busy city streets and are stopping every mile or so to drop off and pick up passengers. The national average speed for light rail is 15 miles per hour.[90] Valley Metro claims its operation will beat this speed and average 21 miles per hour along the rail route.[91] Even at 21 mph light rail is still slower than Valley Metro's estimate of automobile speeds in the year 2020. According to the environmental impact statement, if light rail is not built, automobiles will average 22 mph in 2020.[92]

Automobile travel also has the advantage of direct point-to-point access and no waiting. Your car is waiting for you in your driveway. You don't have to walk to a transit stop. You leave when you are ready. You don't have to wait for a bus or train. You go straight to your destination. You are not forced to abandon your vehicle partway and wait to transfer to a connecting vehicle as one must with transit service. No, the superior convenience of automobiles will ensure that they dominate person-miles of travel even under the most optimistic of assumptions made on behalf of transit. Only the tiny minority that has no alternative or just happens to live and work within a few hundred feet of trolley stops will find transit a satisfactory mode of travel for the relatively short trips they take. Public transit will continue to be overwhelmingly local in nature. If it is to be publicly subsidized it is more appropriate that the decision to do so be locally based rather than regionally based.

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[89] Central Phoenix/East Valley Light Rail Project, FY 2004 Section 5309 Annual Report on New Starts (Valley Metro), Table VII-1, average of first & last year, bus rider total multiplied by 3.77 mile average trip length for bus transit and light rail rider total multiplied by 4.28 mile average trip length for light rail in the 2003 Public Transportation Fact Book (American Public Transportation Association), Tables 5 & 6.Central Phoenix/East Valley Light Rail Project: Final Environmental Impact Statement, (Valley Metro), Table S-8, Central Phoenix/East Valley Light Rail Project: Final Environmental Impact Statement (Valley Metro), average of first and last year.

[90] *2003 Public Transportation Fact Book* (American Public Transportation Association), Table 20, p. 43.

[91] *Central Phoenix/East Valley Light Rail Project: Final Environmental Impact Statement*, (Valley Metro, November 2002), p. 1-8.

[92] *Central Phoenix/East Valley Light Rail Project: Final Environmental Impact Statement*, (Valley Metro, November 2002), p. S-18. Vehicle miles divided by vehicle hours from Tables S-8 & S-9.

Table 17: Estimated Geographic Distribution of Light Rail Taxes & Spending			
City or town	**Taxes Paid** (in millions)	**Spending** (in millions)	**Local Return on Each Tax Dollar**
Winners			
Tempe	$57.5	$128.8	$2.24
Phoenix	$508.5	$987.8	$1.94
Losers			
Mesa	$171.7	$85.9	$0.50
Glendale	$86.1	$21.5	$0.25
Scottsdale	$86.8	$0.00	$0.00
Chandler	$71.7	$0.00	$0.00
Gilbert	$56.8	$0.00	$0.00
Peoria	$46.9	$0.00	$0.00
Unincorporated	$40.2	$0.00	$0.00
Goodyear	$15.6	$0.00	$0.00
Avondale	$15.5	$0.00	$0.00
Surprise	$14.0	$0.00	$0.00
Buckeye	$13.3	$0.00	$0.00
Fountain Hills	$12.3	$0.00	$0.00
Queen Creek	$4.6	$0.00	$0.00
Paradise Valley	$4.4	$0.00	$0.00
Wickenburg	$3.1	$0.00	$0.00
Litchfield Park	$3.1	$0.00	$0.00
Cave Creek	$2.8	$0.00	$0.00
Tolleson	$2.1	$0.00	$0.00
El Mirage	$2.0	$0.00	$0.00
Guadalupe	$1.9	$0.00	$0.00
Carefree	$1.4	$0.00	$0.00
Youngtown	$0.9	$0.00	$0.00
Gila Bend	$0.8	$0.00	$0.00

Efficiency, Equity, and Effectiveness

In order to evaluate the merits of any prospective transportation policy or program, it behooves us to consider the criteria of efficiency, equity, and effectiveness. *Table 14: Relative Performance for Phoenix Transportation Options* compares light rail, bus, and auto passenger transportation modes. From the data it is clear that the automobile/roadway combination provides a more efficient, more equitable, and more effective means of meeting the region's transportation needs than either bus or light rail. The claim that expanding public transit is necessary in order to produce a more "balanced" transportation system is not persuasive. Viewing how little is obtained for the high costs, pouring more taxes into public transit is akin to adding an extra helping of lard to an already fat-laden public sector diet. It would be fiscally unhealthy.

Table 18: Relative Performance for Phoenix Transportation Options					
	Efficiency		*Equity*		*Effectiveness*
Mode	Cost per Rider-mile	Cost per trip*	Rider share of cost	Non-rider share of cost	Share of regional travel
Light Rail	$2.90	$12.39	5%	95%	0.2%
Bus	$1.87	$8.04	15%	85%	0.9%
Road/Auto	$0.35	$1.51	100%	0%	98.9%

Sources:

Central Phoenix/East Valley Light Rail Project, FY 2004 Section 5309 Annual Report on New Starts (Valley Metro), Table VII-1, average of first & last year, bus rider total multiplied by 3.77 mile average trip length for bus transit and light rail rider total multiplied by 4.28 mile average trip length for light rail in the *2003 Public Transportation Fact Book* (American Public Transportation Association), Tables 5 & 6.

Central Phoenix/East Valley Light Rail Project: Final Environmental Impact Statement, (Valley Metro), Table S-8, *Central Phoenix/East Valley Light Rail Project: Final Environmental Impact Statement* (Valley Metro), average of first and last year.

Regional Transportation Plan (Maricopa Association of Governments).

The American Dream Coalition, http://americandreamcoalition.org/transportcosts.xls

Jason Carey, *1999 Update of the Arizona Highway Cost Allocation Study* (Arizona Department of Transportation, August 1999), p. 13 and Nadia Mansour and John Semmens, *The Value of Arizona's State Highway System: A Corporate Style Financial Analysis* (Arizona Department of Transportation, October 1999), p. 11.

*based on typical transit trip length of 4.3 miles

MORE COST-EFFECTIVE ALTERNATIVES

Improving urban transportation is a goal virtually everyone can support. The key issue is how can we achieve the best results at the least cost? With this in mind, let's take a brief look at a number of more promising answers to urban travel needs and air pollution problems.

Improve the Road System

While much maligned in fashionable circles, the auto/road transportation combination has been a great success. The freedom and mobility that this combination provides is the explanation for its domination of the urban travel environment. In Phoenix, cars provide more passenger transportation in a day than the transit system provides in three months.[93] As good as the road system is, it can always be made better. Some of the options for improvement include the following:

Build More Freeways

The mantra of transit advocates is that we cannot build our way out of congestion. Strictly speaking, this is not true. We could, if we were willing to spend the money, build enough freeway capacity to handle growing traffic. Whether we would want to spend the money is a different question. Under the MAG Transportation Plan, new urban freeways are projected to cost about $12 million per lane mile to build.[94] Both freeways and light rail tracks are expensive

[93] *Central Phoenix/East Valley Light Rail Project: Final Environmental Impact Statement* (Valley Metro), Table S-8, average of first and last year and Table VII-1, average of first & last year, bus rider total multiplied by 3.77 mile average trip length for bus transit and light rail rider total multiplied by 4.28 mile average trip length for light rail in the *2003 Public Transportation Fact Book* (American Public Transportation Association), Tables 5 & 6.

[94] *Regional Transportation Plan* (Maricopa Association of Governments), Table 1: Freeway/Highway Projects Phasing.

to build. The key distinction is that freeways would likely carry 40 times as many person-miles of travel per dollar of tax expenditure as the light rail line.[95] A study done by The Road Information Program found that areas that were more active in increasing regional road capacity experienced congestion increases that were 40% less than areas that were less active in expanding road capacity.[96] So, if transit advocates are suggesting that the community ought to spend large sums to improve traffic, it would be far more cost-effective to build freeways than new rail lines.

Improve Traffic Signal Coordination

For city streets, a main focus is on improving the traffic flow by optimizing the coordination among traffic signals. Often this optimization is referred to as traffic signal synchronization. The simplest type of traffic signal synchronization is to time the cycle of red/green to correspond to the normal speed of the vehicles moving in the peak volume direction. Modern electronics permit more sophisticated techniques for controlling and improving traffic flow. Poorly timed traffic signals can increase traffic delay and fuel consumption by 40 percent.[97]

States that have pursued improvements in traffic signal coordination have reported good results. The benefits to highway users in terms of saved time and fuel have been substantial. A traffic signal coordination program in California reported a reduction in traffic delay of 14 percent.[98] A study in Texas reported a reduction in traffic delay of 30 percent.[99] In Arizona, the "Rhodes" study found reductions in traffic delay of 27 percent when traffic monitoring computerized signals were used.[100] If similar results could be achieved throughout the area, traffic congestion in the Phoenix metropolitan region could be reduced by about 8 percent. It would affect all traffic at all hours of the day. It would also save drivers the cost of unnecessarily burned fuel.

Replace Existing Highway Taxes With Congestion-Based Pricing

Roads are subject to wide fluctuations in demand. As a result, road capacity that is inadequate during some hours of the day is grossly excessive at other times of the day. Congestion pricing should replace rather than be added on top of existing highway user taxes in order to avoid the inequities of enforcing double payments for the same service and the inefficiencies of the existing tax structure.

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[95] *Regional Transportation Plan* (MAG), Table 1: Freeway/Highway Projects Phasing, costs divided by share of 20 years of vehicle miles of travel on new lanes & *Central Phoenix/East Valley Light Rail Project* (Valley Metro), p. V-3 cost per trip divided by 4.28 mile average trip length for light rail in the *2003 Public Transportation Fact Book* (American Public Transportation Association), Tables 5 & 6.

[96] *The Best Solutions to Traffic Congestion: Dispelling the Myths about the Impact of Expanding Roads* (The Road Information Program, 1726 M Street, NW, Suite 401, Washington, DC 20036; Ph: 202.466.6706; http://www.tripnet.org)(Dec 1999)

[97] *National Signal Timing Optimization Project* (Federal Highway Administration, Office of Traffic Operations, May 1982).

[98] Peter S. Parsonson, *Signal Timing Improvement Practices, Synthesis of Highway Practice #172* (National Cooperative Highway Research Program, Transportation Research Board, 2101 Constitution Avenue, NW, Washington, DC 20418, 1992).

[99] *Benefits of the Texas Traffic Light Synchronization Grant Program II* (Texas Department of Transportation, February 1995).

[100] *Rhodes: Real-Time Traffic-Adaptive Signal Control* (Systems and Industrial Engineering Department, University of Arizona, 1997).

We are used to thinking of peak period traffic as commuters driving to and from work. However, not all peak period trips are work commutes. In Southern California over 60 percent of peak period trips are not work related.[101] Another estimate of non-work trips during the peak traffic periods placed the figures at 50 percent for the A.M. peak and nearly 70 percent for the P.M. peak.[102]

Diverting some of this discretionary travel to off-peak periods by way of a pricing differential would reduce traffic congestion and improve the efficiency of the road system. A study done in Washington called congestion pricing the best strategy for reducing traffic congestion.[103] Private sector businesses faced with this type of fluctuation in demand often resort to peak/off-peak pricing structures to try to smooth out fluctuations and make more efficient use of their existing capacity. Businesses that have used this strategy to good effect include movie theaters, airlines, electric power companies, hotels, and phone companies. In fact, the widespread use of prices that vary according to the volume of demand is more aptly termed "commercial pricing," according to one eminent transportation economist.[104]

Economists of various ideological leanings who have dealt with the issue of traffic congestion are virtually unanimous in their support of pricing as the most effective solution.[105] Non-pricing methods of attempting to reduce traffic congestion have limited effectiveness. Their impact is frequently measured in the fractions of a percentage reduction of peak period traffic.[106] In contrast, congestion pricing could readily reduce peak traffic volume by 25 percent or more.[107] For example, congestion pricing in Singapore is estimated to have reduced peak period traffic by 65 percent.[108] The evidence appears persuasive that congestion pricing can be an effective method of matching urban traffic to roadway capacity. One study estimated that for a limited set of severely congested urban freeways in the United States net annual benefits of $3.0 to $5.3 billion could be achieved.[109] So persuasive is the evidence for congestion pricing that one researcher has called its implementation "inevitable."[110]

In the past, we lacked the technology to employ efficient road pricing. Such road pricing as exists in most places still employs the cumbersome "stop-pay-toll" methods that give many

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[101] Robert Poole, *Private Tollways: Resolving Gridlock in Southern California* (Los Angeles: Reason Foundation, May 1988), p. 5.
[102] Anthony Downs, *Stuck in Traffic* (Washington, D.C.: The Brookings Institution, 1992), pp. 15-16.
[103] *Road Relief: Tax and Pricing Shifts for a Fairer, Cleaner, and Less Congested Transportation System in Washington State* by Todd Litwan *et al* . (Energy Outreach Center, 610 E. 4 Ave., Olympia, WA 98501; phone: (360) 943-4595; http://www.eoc.org) (1998)
[104] Gabriel Roth, *Roads in a Market Economy* (Ashgate Publishing Company, Old Post Road, Brookfield, VT 05036-9704, 1996).
[105] Kenneth A. Small, "Urban Traffic Congestion," *The Brookings Review* (Spring 1993), p. 8; also Anthony Downs, *Stuck in Traffic* (Washington, D.C.: The Brookings Institution, 1992), p. 151; Robert Poole, *Introducing Congestion Pricing on a New Toll Road* (Los Angeles: Reason Foundation, September 1992); Kenneth Small, *et al*., *Road Work* (Washington, DC: Brookings Institution, 1989), p. 87; *Examining Congestion Pricing Implementation Issues*(Washington, D.C.: U.S. DOT, FHWA, December 1992).
[106] *Congestion Management Systems Alternatives*, (Parsons Brinkerhoff, October 7, 1993), pp. B-2 to B-4.
[107] Kenneth Small, *et al*., *Road Work* (Washington, DC: Brookings Institution, 1989), p. 94; and David Anderson and Herbert Mohring, *Congestion Costs and Congestion Pricing for the Twin Cities* (Minnesota Department of Transportation, August 1996), p. 29.
[108] R.S. Taylor-Radford, "Rush Hour Remedy," *Reason* (January 1982), p. 26.
[109] "The Long-Term Value of Value Pricing in Metropolitan Areas" in *Transportation Quarterly*, Volume 56, No. 3, by Patrick DeCorla-Souza (ENO Transportation Foundation, 1634 I St. NW, #500, Washington, DC 20006; Phone 202-879-4700; http://www.enotrans.com) (Summer 2002)
[110] Kenneth A. Small, "Urban Traffic Congestion," *The Brookings Review*(Spring 1993), p. 9.

people nightmares of traffic jams and irate motorists. Fortunately, stopping vehicles to collect payment for use of the roads is no longer necessary. Modern technology has overcome this difficulty. Technology employed in the Hong Kong experiment with electronic road use pricing included on-board transponders (also known as "electronic license plates"), roadside toll readers, video recorders, and computerized billing.[111] This process was assessed as technically feasible and cost-effective.[112] Inexpensive transponders make charging for highway use as simple as charging for long distance telephone use. Using this technology will improve both equity and efficiency.

Encourage Cost-Effective Alternatives to Driving Alone

Traditional transit buses and trains are an inflexible and inefficient means of attempting to provide alternatives to the "drive-alone" auto trip. Trains are the epitome of inflexibility as an expensive track infrastructure is dedicated to one sole use. Standard transit buses, while not inherently as inflexible as trains, are often operated as if they were confined to a fixed track. The inconvenience of this style of service limits its appeal to potential customers. Limited appeal leads to limited use and unjustifiably high per passenger costs. Some less costly alternatives include the following:

Carpooling and HOV/HOT Lanes

Nationally, carpooling accounts for about 16 percent of commuter trips. This is about five times as many person-trips as is accounted for by transit.[113] One factor that deters many from carpooling is the inflexibility that it often imposes on participating members. On the one hand, participants do not want to inconvenience their fellow carpool members by making them wait in the event work demands run past the normal quitting time. On the other hand, participants have a fear of being stranded and miss the carpool connection (or last bus) if they must work overtime. A remedy for this that has been fairly successful is the "guaranteed ride home" program employed by some companies. A guaranteed ride home program would encourage carpooling by ensuring that participants would not have to either inconvenience fellow carpool members or risk being stranded. Under these programs, employers bear the expense of a taxi for the employee's ride home. On a per ride basis, this sounds expensive--averaging $53 in one study. However, since the guaranteed rides are infrequently used they may be more appropriately viewed as a cost-effective "insurance" premium.[114]

Currently, the high-occupancy-vehicle (HOV) lanes on the freeways are underutilized. Despite a higher potential person-mile carrying capacity, HOV lanes actually accommodate only about half as many passengers per lane per hour as the abutting general use lanes during congested periods.[115] Some have suggested that traffic congestion could be eased by simply converting HOV lanes into general purpose lanes. If the only choice were this conversion or

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[111] *Electronic Road Pricing in Hong Kong: The Pilot Stage* (Transport Branch, Government Secretariat, Hong Kong, July 1983), p.11.

[112] *Electronic Road Pricing Pilot Scheme: Main Report*, (Hong Kong: Transpotech, May 1985), p. 2.

[113] Erik Ferguson, "Demographics of Carpooling," *Transportation Research Record #1496* (Transportation Research Board, 2101 Constitution Avenue, NW, Washington, DC 20418, 1995).

[114] Christopher Park, "Evaluation of Second-Year Effectiveness of Guaranteed Ride Home Service at Warner Center Transportation Management Organization," *Transportation Research Record #1338* (Transportation Research Board, 2101 Constitution Avenue, NW, Washington, DC 20418, 1991).

[115] Mark Poppe, *et al*., "Evaluation of High-Occupancy-Vehicle Lanes in Phoenix, Arizona," *Transportation Research Record #1446* (Transportation Research Board, 1994).

keeping them as they now are, operating way below capacity, we might as well do it. There may, though, be another choice. Instead of letting the unused HOV capacity go to waste, it has been suggested that it be "rented" to single occupant vehicles (SOVs). Drivers of SOVs who were willing to pay a fee for the privilege would be permitted to drive in the underutilized HOV lanes during the periods when the general purpose lanes are congested. Thus, the previously exclusively HOV lanes would be converted into HOT (high occupancy/toll) lanes.[116] The State Route 91 tollway in California is, in fact, a HOT facility--high occupancy vehicles travel free while SOVs pay a toll based upon the amount of congestion in the parallel general use lanes. This strategy provides some traffic congestion relief, not only for the SOVs paying to get into the HOV lane, but also for the SOVs left behind in the general purpose lanes. It would also generate some revenue that could be used to build more HOV lanes.

Restructure Public Transportation

Rather than trying to jealously preserve an exclusive traditional public transit monopoly, we could create more opportunity for purveyors of private transit services. A private sector transit service would likely be a van or small bus that would follow a semi-fixed route. It could offer more door-to-door service than a larger bus. Both waiting time and in-vehicle travel time for passengers would be reduced. Riders of private transit services in other cities report that they feel safer than on city buses since drivers are more apt to refuse to pick-up disorderly or dangerous passengers. These types of services are also most popular in corridors that serve the transit dependent[117] and have been successful in a number of U.S. and foreign cities, often offering a higher quality, yet lower priced service than public transit buses.[118]

The potential of private sector transit has not been fully realized because private operators are disadvantaged by having to compete with heavily subsidized municipal bus systems.[119] Since private sector operators would have to cover 100 percent of their costs from earned revenue they would have to be five times as efficient as municipal bus operators (who, because of local and federal government subsidies, must cover only one-fifth of costs from earned revenue) in order to beak-even charging competitive fares.

A second component for a possible transit restructuring concept would be to modify the existing subsidy program. Ideally, there ought not to be any subsidies. However, until we are ready to implement this ideal we may have to settle for a less damaging method of dispensing the subsidy. Currently, the subsidies from federal, state, and local taxes flow directly to the transit system operators. Instead, we could shift the focus of the subsidies to the riders. This could be accomplished by selling public transportation "tokens" to prospective riders at a price comparable to current fares. The transit operators would redeem these tokens for amounts comparable to the current per trip cost of the Phoenix Transit system. Discounts from the normal fares would be handled through social service agencies. Social service agencies wanting to

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[116] Gordon Fielding and Daniel Klein, *High Occupancy/Toll Lanes: Phasing in Congestion Pricing a Lane at a Time* (Reason Foundation, 3415 S. Sepulveda Blvd., Los Angeles, CA 90034, November 1993) and "HOT Lanes: A Better Way to Attack Urban Highway Congestion" by Robert W. Poole Jr. and C. Kenneth Orski in *Regulation* (Vol. 23, No. 1)(Cato Institute, 1000 Massachusetts Avenue, N.W., Washington D.C. 20001-5403; Phone (202) 842-0200; http://www.cato.org)(2000).

[117] *Alternative Transportation System Task Force Report to Governor Fife Symington* (November 15, 1996), p. C-16.

[118] Daniel Klein, *et al., Curb Rights: A Foundation for Free Enterprise in Urban Transit* (Brookings Institution, 1997), pp. 41-46.

[119] *Ibid*., p. 45.

provide even larger subsidies for certain categories of public transportation users (like the indigent or elderly) could buy the tokens at the regular price and resell them at a lower price (or give them away) to their clients.

The "flat" fare structures typically employed by transit systems is both inefficient and inequitable. Those traveling longer distances are undercharged relative to those traveling shorter distances. This discourages the more cost-effective shorter trips and encourages the more costly longer trips. The buses incur more empty seat-miles venturing further from the central core of the city. This worsens the performance of the total system. Fares should not, therefore, be structured to reward or induce passengers to demand these longer trips. Fares should be structured to facilitate more cost-effective usage of public transportation. A method for implementing a more efficient and equitable fare structure would be to institute some sort of fare-zone system. Trips within one zone would cost one token. Trips involving travel in two zones would be priced at two tokens, etc. Inasmuch as the average trip length on the current transit system is only four miles, most trips in our reconstituted public transportation environment would not involve more than one "zone." By using a zone-based fare structure, use of public transportation in the most congested areas would be encouraged, while use of public transportation for costly and inefficient long distance trips would be discouraged.

The public transportation tokens could be sold through city offices, convenience markets, vending machines or other outlets along or near public transportation routes. The tokens would be redeemable only by bonafide public transportation operators. To qualify as a bonafide public transportation operator, a business would have to have appropriate vehicles and keep financial and operating records documenting the number of passengers served. Audits of these records and spot checks of on-the-road operations would need to be conducted to ensure that the redeemed tokens were, indeed, acquired by actually providing transportation.

Since the subsidies provided by federal, state, and local taxes are for designated public transportation purposes, operators redeeming the tokens would be required to demonstrate that the appropriate portions of the subsidy funds received from redeeming the tokens were being deployed as required by law for capital and operating expenses. Basically, 50 cents of every dollar's worth of tokens redeemed would be subject to the requirement that federal aid for "capital" expenditures (about 20 to 25 percent of the total government subsidy) and federal aid for operations (about 10 percent of the total government subsidy) be reinvested by the recipient public transportation firm in capital and operating expenditures. Another alternative would be for the city to own the vehicles financed via federal aid and lease them to private sector operators. Such leases should be structured to accommodate competition. Since the amounts that private sector firms would be willing to pay to lease the vehicles would be directly related to the functionality and efficiency with which the vehicles could be operated, the city would have a strong incentive to procure the types of vehicles needed in the public transportation marketplace.

Inasmuch as it seems likely that privately operated buses could make a profit under this system, after all, privately operated transit has been shown to operate at costs considerably lower than municipally owned transit,[120] competition may well become quite robust. We would be moving toward a more self-sustaining public transportation system and away from the growing deficits and tax increases that have plagued the traditional municipal transit monopoly approach.

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[120] Charles Lave (ed), *Urban Transit* (Cambridge, Massachusetts: Ballinger Publishing Co., 1985), pp. 67-68; Joseph Schweiterman, *Private Sector Participation in Chicago Mass Transit* (Heartland Institute, December 1984); and Wendell Cox, *U.S. Competitive & Non-Competitive Urban Transport Costs: 1990* <http://www.il.net/~policy/ut-comp.htm>

Promote Privately Operated "Subscription" Buses

These types of buses have provided service for half the cost of public transit buses in such cities as Chicago and Los Angeles.[121] The main deterrent to the rise of this form of transit is the heavy subsidization of municipal bus lines. These subsidies permit the municipal transit bus to charge customers only a third, or less, of the cost to provide the service. Private firms without recourse to tax-financed subsidies must cover their full costs to stay in business. To compete on the basis of price with the level of subsidy provided to Phoenix's public transit, privately operated buses would have to have costs that were 80 percent lower. Halving or eliminating the subsidy would provide a more "level playing field" for all transit providers.

Implement More Innovative Employment Practices

Since most of the traffic problems occur during so-called rush hours when employees are commuting to and from jobs, some changes in employment practices might help alleviate some of the worst traffic congestion. Some potentially helpful measures include the following:

More Use of the "Compressed" Work Week

To the extent that the traditional 40-hour workweek could be converted from a five-eight-hour-day schedule to a four-ten-hour-day schedule, the number of work trips could be reduced and peak-hour traffic congestion partially mitigated.

More Use of "Flex Time"

To the extent that work trips might be spread out over a wider interval, the peaks of the peak periods will be lower. This may help reduce some of the capacity overloads that aggravate the traffic congestion problem.

More Use of "Proximate Commuting"

Proximate commuting is an idea developed by Gene and Carolyn Mullins.[122] The overwhelming majority of commuters make their work trips in single-occupant vehicles. This is despite massive and ongoing attempts to induce them to do otherwise. We have seen billions spent on expanding bus systems and building rail lines. We have seen millions spent to build high-occupancy vehicle lanes. We have seen considerable effort expended to try to persuade people to carpool or ride transit. We have even seen the outbreak of punitive mandates for "trip reductions" inflicted on employers. Still, the overwhelming majority of commuters insist on driving their own cars.

The freedom and mobility offered by the privately owned and operated car is a highly valued privilege. It is not likely to be overcome by any government policy tolerable in a democratic society. Rather than bewail this situation or berate those who choose to drive alone, maybe we should try to adapt to the expressed preferences of the commuting population. This is the strategy taken by the proximate commuting concept. Finding a way to accommodate the desire to drive alone, yet still reduce traffic congestion is apt to accomplish more than plans that envision coercing people out of their cars.

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[121] Charles Lave, (ed.), *Urban Transit* (Cambridge, Massachusetts: Ballinger Publishing Co., 1985), pp. 67-68 & 162-166 and Joseph Schweiterman, *Private Sector Participation in Chicago Mass Transit* (Heartland Institute, December 1984).

[122] Mullins & Associates, 220 West Mercer St., Suite 500, Seattle, Washington, 98119-3954.

Instead of trying to get commuters to give up their cars, proximate commuting seeks to shorten their work trips. The work trip is shortened by moving the place of employment closer to the employee's home. While not a viable strategy for many types of businesses, proximate commuting would appear highly suitable for businesses that have multiple work sites. Businesses fitting this description would include banks, restaurant chains, retail chains, public schools, and some government offices (for example, Motor Vehicle Division offices that issue driver's licenses and registrations). To the extent feasible, workers could be transferred to work sites closer to their homes. Their commute distances would be reduced. This would help reduce some of the peak period traffic volume.

A test of the proximate commuting concept was conducted in the Seattle metropolitan region in 1995. During a 15 month "demonstration project" nearly 500 employees at 30 branches of the Key Bank of Washington were given the opportunity to participate. About one-in-six of these eligible employees elected to participate. On average, those participating reduced their work commute trip distance by 65 percent. Because the employees with the longest trips were more likely to choose to participate, the average reduction in commute miles per bank branch was 17 percent.[123]

Another attractive feature of proximate commuting is that it doesn't require large public outlays. Employees of multiple site businesses are encouraged to participate by the opportunity to save time and money on their daily work commute trips. Employers are encouraged to participate as a means of extending a money-saving benefit to employees that does not require a cash outlay by the business. Proximate commuting is an example of the much sought "win-win" solutions.

More Telecommuting

Telecommuting reverses the basic work process by moving the work to the workers rather than moving the workers to the work. Instead of getting in a car or on a bus and transporting his or her body to work, the telecommuting employee sends the work to his or her employer. Common modes of transporting the work include oral transmission by telephone, facsimile transmission over the phone lines, or e-mail transmission over the internet. The contrast in time and energy required to transport a person vs. transporting the work is quite dramatic. The average work commute by car is about 12 miles. Moving a 150 lb. person 12 miles in a one-ton automobile twice per workday will consume about 50 minutes of time. It will cost a little over $7 (29 cents/mile x 12 miles x 2 commute trips/workday). Traveling this same distance by bus in Phoenix under the planned expansion will cost almost $40 ($ 1.59 cents/mile x 12 miles x 2 commute trips/workday in taxes plus about $1.20 in fare revenue) and by light rail would cost about $67 ($2.75/mile x 12 miles x 2 commute trips/workday in taxes plus about $1.20 in fare revenue).[124] Moving this person's work via telecommuting would take a few minutes by FAX and a few seconds by internet. Since the transmission of data to a workplace an average of 12 miles away would be a "local call" the cost for using the phone lines would be a few pennies.

Obviously, telecommuting cannot work for all types of work. It is largely restricted to work that involves the production of information. These jobs might involve research or data

[123] Gene Mullins and Carolyn Mullins, *Proximate Commuting: A Demonstration Project of a Strategic Commute Trip Reduction Program* (Washington State Department of Transportation, Office of Urban Mobility, 401 Second Avenue South, Seattle, Washington 98104), p. 69.
[124] *Central Phoenix/East Valley Light Rail Project* (Valley Metro), p. V-3 and Table 9.

analysis, the end product of which is typically some sort of written document (for example, a report, a memo, a financial statement). The types of jobs that would be amenable to telecommuting would include a typical assortment of "white-collar," office jobs like accountant, statistician, secretary, data processor, engineer, etc. Jobs requiring the physical presence of the employee would not be suitable candidates for telecommuting. These would include jobs like manufacturing assembly, waiters, barbers, police officers, etc.

The potential reduction of traffic congestion and air pollution from a more widespread resort to telecommuting seems promising. A pilot project in California indicated that telecommuting workers reduced their peak-period trips by 60 percent, their total vehicle miles driven by 80 percent, and their freeway use by 40 percent. The program also inspired many of the participants to seek out shopping, recreation, and other non-work related activities at locations closer to their homes, even on non-workdays.[125] A demonstration project in the Seattle metropolitan region found that telecommuters reduced vehicle miles of travel by 66 percent and the number of workday trips by 32 percent.[126]

While reducing traffic congestion and improving air quality are good public-spirited reasons to promote telecommuting, there are also other more pecuniary rationales to bolster the motivation for the participants. Telecommuting workers save themselves the time it would otherwise take to travel to work. This is the equivalent of getting an increase in one's hourly rate of pay. They save auto operating costs and/or transit fares. They may also obtain non-economic benefits like getting to spend more time with their families, avoiding the stress and risks of driving in traffic, setting their own work hours, and not having to "suit-up" to go to the office. Employers of telecommuting workers may be able to save by reducing the amount of office space needed. An analysis by American Express estimated the annual savings in office expense for each telecommuting "full-time-equivalent" employee at $15,000 per year.[127] In addition, employers seem to get improved productivity out of their telecommuting workers. The benefits enjoyed by telecommuting employees may be roughly equivalent to getting raises and upgraded working conditions (at no cash cost to the employer) that serve to motivate better performance. Typical productivity gains are reflected in faster completion of work assignments, fewer sick days, better time management, and increased morale. Pacific Bell estimated a net productivity gain of 20 percent and savings of at least $500,000 in office space costs from its telecommuting program.[128] In fact, it appears that output gains in the 20 percent range are common for telecommuting workers.[129]

Consider Implementing SkyTran

SkyTran is a different kind of transit concept. It proposes to provide transportation for the masses without requiring them to "mass" in order to use it. Taking a hint from the fact that a small capacity vehicle like the automobile accounts for over 90 percent of urban travel, the SkyTran concept focuses on the attributes that make the auto attractive and incorporates them

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[125] Katherine Turnbull, *et al*. *Potential of Telecommuting for Travel Demand Management* (Texas Transportation Institute, November 1995).

[126] Dennis K. Henderson and Patricia L. Mokhtarian, *Impacts of Center-Based Telecommuting on Travel and Emissions: Analysis of the Puget Sound Demonstration Project* (Institute of Transportation Studies, University of California, Davis, CA 95616), p. 26.

[127] Comment by Al Gore at the Phoenix Economic Discussion Group dinner, June 11, 1997.

[128] Katherine Turnbull, *et al*. *Potential of Telecommuting for Travel Demand Management* (Texas Transportation Institute, November 1995).

[129] *Telecommuting: Moving the Work to the Workers* (US DOT, Technology Sharing Program, September 1991).

into its transit system. SkyTran is a version of personal rapid transit (PRT). Information on other PRT ideas can be found at http://faculty.washington.edu/~jbs/itrans/PRT.

Buses and trains require passengers to accumulate into groups for transport. Stations and stops serve as gathering points for passengers to await the transit vehicle. Of necessity, this confines travel to a set schedule and route. As a result, passengers must wait, often they must endure circuitous routing or make transfers to connecting buses or trains, and sometimes they must ride standing. All of these factors constitute unattractive features for the traveling public. Journeys are made more time consuming (buses average speeds of only 13 mph and light rail trains only 16 mph[130]), less convenient, and more uncomfortable. In contrast, the automobile is available for its owner on his or her schedule. There is no waiting. There are no transfers to be made. A seat is guaranteed. Consequently, the low quality of transit compared to auto transportation has fostered transit's loss of market share to the automobile.

With this contrast in mind, the designer of SkyTran devised a system that features a small vehicle that is available on demand, requires no transfers, and travels at high speeds providing non-stop service to the passenger's chosen destination. These features give SkyTran a chance to compete for the segment of the urban travel market now dominated by the automobile.

Best of all, SkyTran is being offered to urban regions without the necessity of tax subsidies. The company believes that their system will be self-supporting from passenger fares. The only request they are making of city officials is permission to use the air space over existing rights-of-way. This is certainly a better offer than any city has ever gotten from those promoting traditional bus and rail transit systems. An outline of the SkyTran concept and a side-by-side comparison with light rail can be found on their website at http://www.skytran.net.

Alternative Air Quality Measures

Since part of the rationale behind the advocacy of transit expansion is concern over air quality, we may want to consider measures that, while not reducing traffic congestion, *per se*, may help reduce vehicle caused air pollution. It is widely acknowledged that a minority of the vehicles is responsible for a majority of the pollution.[131] Getting these vehicles tuned-up or removed from traffic is likely to have a far greater impact on air quality than any other option. Some potentially helpful measures in this category include the following:

Super Emitter Measures

A governor's task force in Arizona recommended four options for reducing the emissions of the worst polluting vehicles: (1) a vehicle license surcharge, in which high polluting vehicles would have to pay more to register their vehicles, (2) an emission fee assessed at the emission testing site, (3) retrofitting older vehicles with catalytic converters, and (4) accelerating the "retirement" and scrapping of older vehicles. All of these measures would likely have large impacts on air pollution (about 30 times greater than transit expansion) and relatively small costs to implement (about 95 percent to 99 percent less than transit expansion).[132]

Mobile Emission Enforcement

Mobile emission enforcement helps to overcome the "clean-for-a-day" problem with stationary annual testing. Under mobile emissions enforcement, a vehicle could be checked while

[130] *Transit Fact Book* (American Public Transit Association, 1999), p. 82.
[131] Michael Fumento, *Science Under Seige* (New York: William Morrow & Co., 1993), p. 325.
[132] *Alternative Transportation System Task Force Report to Governor Fife Symington* (November 15, 1996), p. S-11.

it is moving at a variety of locations and at any time. Drivers would need to keep their vehicles tuned year-round, not just on an inspection day largely of their own choosing. The technology is deemed accurate and cost-effective.[133]

CONCLUSION

By any reasonable standard, public transit is a bad investment. It is a dying industry, and for good reason. The type of service typically offered is of low quality. Average travel times are long compared to travel in cars. Transit customers must walk to bus stops and train stations. They must wait for buses and trains. Sometimes they must travel standing. Frequently they must change vehicles. It is not surprising that transit carries such a small share of urban travel. There is nothing planned or proposed for transit by public transit officials that will significantly change this situation--not light rail, not heavy rail, not "maglev" (basically a train levitated and powered by magnetic forces).

Massive subsidy efforts by federal and local governments have failed to revive transit. The billions of tax dollars poured into public transit systems have not reversed its long term decline. Each new increment of tax subsidy has merely deepened the deficits. This exercise in futility imposes real losses on the economy, both at the national and local level. Funds siphoned-off into profitless public transit weaken the economy, cost jobs, and lower the standard of living. Far from being a program that advances the welfare of society's poorest individuals, channeling money into loss-making transit serves to worsen their long-term prospects.

We have also seen that the case for public transit as an environmental improvement measure is feeble. The overwhelming majority of the credit for environmental improvement, both in the past and in the future will belong to the engineers who work on auto technology. Innovations that reduce emissions on the mode that accounts for ninety-some percent of the urban travel will always have greater potential for improving air quality than billions of dollars spent on little used transit systems. In terms of environmental objectives, expanding public transit is merely an expensive "dead end."

Finally, there is the issue of equity. Considering what it has to offer, public transit is grossly over-subsidized. Where did we ever get the notion that the overwhelming majority of non-riders of transit should be forced to pay for the rides of others? Despite the forcible exaction of tax dollars to pay 80 percent of the cost of the transit rides, public transit officials demand still more money. Those weighing their options with respect to increased transit taxes would do well to keep this in mind as they make their decision.

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[133] Donald Stedman, *et al., On-Road Remote Sensing of CO and HC Emissions in California* (California Air Resources Board, February 1994).

ABOUT THE AUTHOR

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