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"Efficiency - Equity - Clarity"

Evaluating Public Transit Benefits in St. Louis

Critique of "Light Rail Boon or Boondoggle"

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Summary

There has been considerable debate over the value of rail transit service. Critics argue that it is economically inefficient and more costly than alternatives, but their analysis often focuses on just one or two of the full economic, social and environmental benefits provided by high quality transit, and underestimates the full costs of accommodating additional automobile traffic on the same corridors. Rail transit can improve mobility for non-drivers, reduce automobile travel and associated costs, and support more efficient land use patterns. As a result, communities with major rail transit systems tend to have less per capita traffic congestion, lower per capita traffic fatalities, lower road and parking facility costs, and consumer cost savings. On congested urban corridors, automobile costs (road and parking facility capacity, congestion impacts, accident impacts and pollution emission damages) are higher than average, resulting in greater than average savings from shifts to alternative modes. Although it would not be cost effective to provide light rail transit service everywhere, when all costs and benefits are considered, rail transit is often the most cost effective way to improve transportation on major urban travel corridors.

A recent paper by Molly D. Castelazo and Thomas A. Garrett ("Light Rail: Boon or Boondoggle" 2004) exhibits typical errors by rail critics. It ignores many benefits of rail transit and understates the costs of automobile travel on the same corridors. Their study fails to reflect current best practices for comparing highway and transit investment cost effectiveness.

Introduction

St Louis, like many cities, is struggling with various transportation-related problems, including traffic and parking congestion, traffic accidents, air and noise pollution, high consumer costs of owning and operating automobiles, and inadequate mobility for non-drivers. Put more positively, well-thought-out transportation policies and plans can help can help solve a variety of urban problems.

Different types of transportation provide different types of benefits and impose different types of costs. There are often debates over the advantages and disadvantages of various options, such as urban highway, bus and rail transit. Which is considered most appropriate for use in a particular situation often depends on how the options are evaluated: when one set of impacts are considered, highway capacity expansion may seem most cost effective, but when additional impacts are considered, bus or rail transit may appear best overall.

A recent paper by Molly D. Castelazo and Thomas A. Garrett ("Light Rail: boon or Boondoggle" 2004) argues that light rail transit investments are inefficient compared with automobile investments. However, their analysis does not reflect best current practices for multi-modal evaluation, that is, for comparing the relative value of highway and transit investments.

This paper describes some of the omissions and errors made in Castelazo and Garrett's paper, and discusses factors that should be considered when evaluating transportation improvement options.

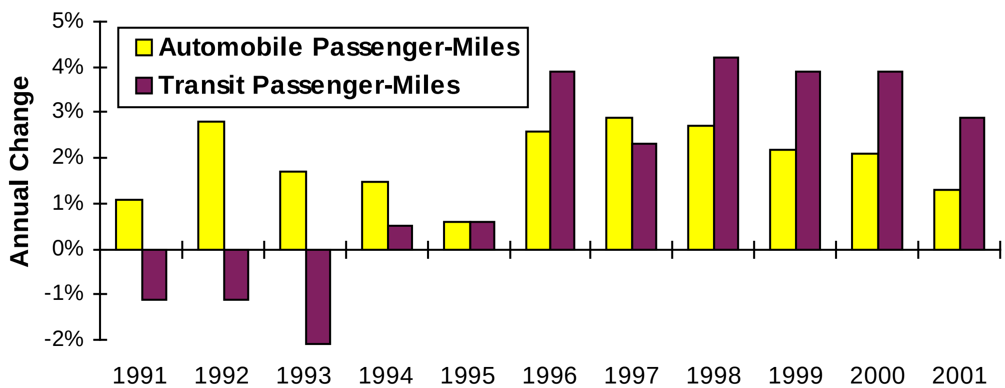
Transit's Role In A Modern Transportation System

Looking back over the last century, public transit may seem to have declining importance. For many decades automobile use (here "automobile" includes cars, light trucks, vans and SUVs) grew, while transit experienced a downward spiral of reduced ridership, investment and service quality. But there are now counterbalancing factors which suggest that transit may become increasingly important in the future:

- There is growing appreciation of potential benefits from integrating transport and land use planning to create more accessible, multi-modal communities.
- Many cities have recently experienced redevelopment and population growth, and some trends (smaller households, more elderly people, increased popularity of urban loft apartments, increased value placed on walkability, etc.) support increased urbanization.
- Many cities have reached a size and level of traffic demand that justifies more reliance on transit, including many areas previously classified as *suburban* that are becoming more urbanized, and so experience increased congestion, commercial clustering, land values and parking problems that make transit cost effective.
- There is a growing realization among transportation professionals and much of the general public that there is a value to having a more diverse transportation system.
- Various combinations of aging populations, traffic problems and environmental concerns are motivating many people to value transit services.

Transit and cities are now experiencing a renaissance. Since the mid-1990s transit ridership has increased, as indicated in Figure 1, and many U.S. cities have experienced population growth and major economic redevelopment.

Figure 1 **Highway and Transit Travel Trends** (BTS, 2003, Table 1-34)



Between 1998 and 2001 transit travel grew faster than automobile travel.

Well designed and maintained roads are critical to any transportation system. They are essential for nearly all travel modes, including walking, cycling, automobile travel, bus transit and freight delivery. Even rail transit depends on road access to stations. But once a community has an adequate roadway system, it is no necessarily desirable to continually expand capacity to accommodate more traffic if other transportation improvements are more cost effective overall. In particular, it is often better overall to encourage more efficient use of existing road and parking capacity than to widen roadways in order to accommodate more peak-period traffic.

The major urban transportation problems facing cities are traffic and parking congestion, traffic accidents, vehicle pollution and inadequate mobility for non-drivers, exactly the problems that rail transit can help solve, as indicated in Table 1.

Table 1 Transportation Problems Transit Helps Solve

• Traffic congestion	• Automobile costs to consumers.
• Parking congestion	• Inadequate mobility for non-drivers
• Traffic accidents	• Excessive energy consumption
• Road and parking infrastructure costs.	• Pollution emissions

Public transit can help address a variety of transportation problems. Transit tends to be most effective on dense urban corridors where these problems are most intense..

This does not mean that every automobile trip should shift to transit or that transit can solve every urban problem. But there are frequently-overlooked benefits from having a diverse transport system. Although few motorists want to completely give up automobile use, at the margin (i.e., compared with their current travel patterns) many would prefer to drive somewhat less and use alternatives more, provided they are convenient, comfortable and affordable.

Comprehensive Evaluation

Transportation economists have developed analysis tools for determining the value to society of a particular transportation policy or investment. Most were developed to evaluate a particular mode or objective. For example, highway investment models (such as MicroBenCost) are designed to measure the value of road improvements, and emission reduction models are designed to prioritize emission reduction strategies. Because of their limited scope, these tools tend to be ineffective at evaluating multiple modes or planning objectives. For example, models designed to evaluate congestion reduction strategies often ignore emission impacts, and models designed to evaluate emission reductions often ignore congestion impacts. Many models ignore parking, vehicle ownership and accident costs. Such "reductionist" models often result in solutions to one problem that exacerbate other problems, and they undervalue strategies that provide multiple benefits, such as transit service improvements.

Conventional transport evaluation models tend to undervalue public transit because they overlook many benefits, as summarized in Table 2. In recent years, transportation economists have developed better methods for analyzing and comparing different types of transportation, often called *multi-modal evaluation* (Cambridge Systematics, 1998; FTA, 1998; Lewis and Williams,1999; DfT, 2002; ECONorthwest and PBQD, 2002; HLB, 2002; Litman, 2004b). An evaluation based on these best practices gives citizens and public officials the information they need to make an informed and fair decision.

Table 2 **Impacts Considered and Overlooked** ("Comprehensive Evaluation" VTPI, 2004)

Usually Considered	Often Overlooked
• Financial costs to governments • Vehicle operating costs (fuel, tolls, tire wear) • Travel time (reduced congestion) • Per-mile crash risk • Project construction environmental impacts	• Downstream congestion impacts • Impacts on non-motorized travel • Parking costs • Vehicle ownership and mileage-based depreciation costs. • Project construction traffic delays • Generated traffic impacts • Indirect environmental impacts • Strategic land use impacts • Transportation diversity value (e.g., mobility for non-drivers) • Equity impacts • Per-capita crash risk • Impacts on physical activity and public health • Some travelers' preference for transit (lower travel time costs)

Conventional transportation planning tends to focus on a limited set of impacts. These omissions tend to undervalue transit improvements.

Rail Transit Benefits

Quality transit service, such as light rail, can provide a number of economic, social and environmental benefits (Hass-Klau and Crampton, 2002; Lewis and Williams, 1999). To the degree that high quality transit attracts travelers who would otherwise drive an automobile, it reduces traffic congestion, road and parking costs, provides consumer cost savings, reduces crashes, and reduces air and noise pollution emissions.

Rail transit can provide special benefits by encouraging higher-density urban development, often resulting in mixed-use urban villages around transit stations. This type of land use pattern has several desirable attributes. Residents of such communities tend to rely more on walking and public transit, and so own fewer cars and drive less than residents of more automobile-dependent communities, resulting in consumer cost savings, road and parking facility cost savings, consumer cost savings, improved mobility for non-drivers, and reductions in per capita accidents and pollution emissions. Only by considering these impacts can rail transit be accurately evaluated.

In a previous study (Litman, 2004a) I divided 130 of the largest U.S. cities into three categories:

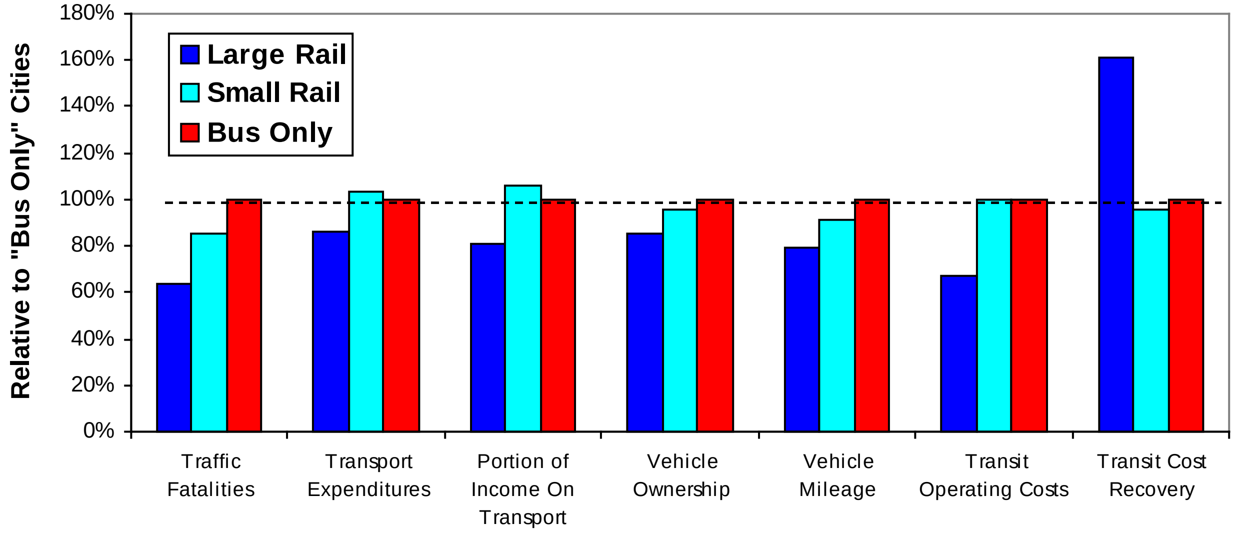
1. *Large Rail* – Rail transit is a major component of the transportation system.
2. *Small Rail* – Rail transit is a minor component of the transportation system.
3. *Bus Only* – City has no rail transit system.

When these categories are compared, Large Rail cities are found to have significantly better transport system performance, including higher per capita transit ridership, lower traffic fatality rates, lower congestion costs, lower per capita transportation expenditures, lower transit unit costs, less per capita vehicle mileage, lower energy consumption and lower pollution emissions. Compared with Bus Only cities, Large Rail cities have:

- 400% higher per capita transit ridership (472 more annual passenger-miles).
- 390% higher transit commute mode split (13.4% versus 2.7%).
- 36% lower per-capita traffic fatalities (4.2 fewer annual deaths per 100,000 residents).
- 14% lower per capita consumer transportation expenditures ($448 average annual savings), despite residents' higher incomes.
- 19% smaller portion of household budgets devoted to transportation (12% versus 14.9%).
- 21% lower per capita motor vehicle mileage (1,958 fewer annual miles).
- 33% lower transit operating costs per passenger-mile (42¢ versus 63¢).
- 58% higher transit service cost recovery (38% versus 24%).

Figure 2 summarizes these benefits.

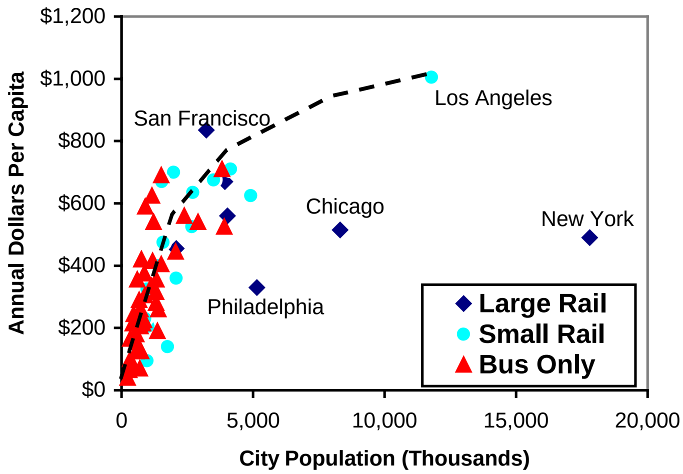
Figure 2 **Transportation Performance Comparison**



This graph compares different categories of cities by various performance indicators. The dashed line at 100% indicates "Bus Only" city values.

Although Large Rail cities have higher average per capita congestion costs, this occurs because congestion tends to increase with city size. When this factor is taken into account, rail transit turns out to significantly reduce per capita congestion costs, as indicated in Figure 3. Matched pair analysis indicates that Large Rail Cities have about half the per capita congestion costs as other comparable size cities.

Figure 3 **Congestion Costs**



In 'Bus Only' and 'Small Rail' cities, congestion costs tend to increase with city size, as indicated by the dashed curve. But Large Rail cities do not follow this pattern. They have substantially lower congestion costs than comparable size cities. As a result, New York and Chicago have about half the per capita congestion delay as Los Angeles.

Economists find that higher-density, mixed land use patterns tend to increase economic productivity, since some industries and economic activities are more efficient when they occur in a clustered area, due to "economies of agglomeration" (Coffey and Shearmur, 1997). This is the reason that cities exist, why universities and research institutions tend to locate together on campuses, why retail and medical services tend to cluster together into special districts, and why certain types of businesses tend to locate in downtowns or other commercial centers, despite high rents and congestion problems. These productivity benefits and consumer savings are often reflected in higher property values near transit stations, and therefore increased tax revenues (Smith and Gihring, 2003).

Automobile transportation is space intensive (it requires large amounts of land for roads and parking facilities), which limits the size of activity centers. A particular commercial center (such as a downtown, or college campus) can accommodate a maximum of about 5,000 cars without requiring huge subsidies for structured and underground parking. To grow beyond this number of employees or visitors a commercial district or activity center must rely on alternative transportation modes, such as ridesharing and public transit, for an increasing portion of travel. Although bus transit can carry commuters efficiently, current diesel-powered buses are noisy and emit significant air pollutants. As a result, many large central business districts depend on rail transit, because it supports high-density land use at lower total cost (including roads, parking and pollution impacts) than either automobile or bus transportation.

Quality transit also supports economic development by saving consumers money and shifting their expenditures. Residents of cities with quality transit systems tend to spend less on transportation overall. For example, residents of cities with large, well-established rail transit systems spend an average of $2,808 on personal vehicles and transit, compared with $3,332 in cities that lack rail systems, despite higher incomes and longer average commute distances in rail cities. This indicates that quality rail transit systems provide consumer cost savings averaging about $500 annually per capita, which is many times larger than the additional taxes required to fund such a system.

Consumer expenditures on vehicles and fuel provide relatively little employment or business activity per dollar because they are capital intensive and most of their value is imported from other areas. One study found that each 1% of travel shifted from automobile to transit in San Antonio, Texas increases regional income about $2.9 million (5¢ per mile shifted), adding 226 regional jobs, as summarized in Table 27. Other studies find similar impacts (ASTRA, 2000).

Table 27 **$1 Million Expenditure Economic Impacts** (Miller, Robison & Lahr, 1999)

Expenditure Category	Regional Income	Regional Jobs
Automobile Expenditures	$307,000	8.4
Non-automotive Consumer Expenditures	$526,000	17.0
Transit Expenditures	$1,200,000	62.2

This table shows economic impacts of consumer expenditures in San Antonio, Texas.

Rail transit has incremental costs as well as benefits (Litman, 2004a). Rail transit services require about $12.5 billion annually in public subsidy (total capital and operating expenses minus fares), which averages about $90 annually in additional public transit subsidies per resident in rail cities compared with bus transit subsidies. However, these incremental costs are more than offset by economic benefits. Rail transit tends to increase regional employment, business activity and productivity. Rail transit systems can contribute to urban redevelopment, increasing business activity and tax revenues. Property values often increase substantially around rail transit stations. Economic benefits more than repay public subsidies: parking cost savings are estimated to total more than $12 billion annually, consumer transport cost savings total more than $22.5 billion annually, and congestion cost savings total more than $19 billion annually. Additional unquantified but potentially large benefits include improved public health, improved community livability and increased opportunity for disadvantaged workers. Many benefits accrue to motorists as well as rail transit riders.

For a typical resident, rail transit represents an average additional investment of $90, which provides $450 in vehicle cost savings, hundreds of dollars a year worth of parking cost savings, a one-third reduction in traffic risk, a significant reduction in congestion delays, improved travel options, and a more livable community. People who currently do not use rail transit benefit from reduced traffic and parking congestion, and various savings passed through the economy. Per capita congestion costs in cities with Large Rail systems are about half those in other comparable cities, although rail systems carry only a small portion of total passenger-miles, indicating that the availability of rail reduces congestion delays to motorists.

Applying Transportation Economics

Castelazo and Garrett argue that travel decisions should be tested based on consumer willingness to pay. Most economists (including myself) believe that an efficient market requires that prices (what consumers pay for a good) should reflect marginal costs (what it costs to produce and provide that good), unless a subsidy is specifically justified on other grounds.

Castelazo and Garrett claim that rail transit fails to meet this test, since rider fares only cover about a third of operating costs, and an even smaller portion of total costs, when capital costs are also considered. However, they ignore the underpricing of urban automobile travel, including significant subsidies for roads and streets (much of which is funded through general taxes rather than direct user fees), subsidized parking facilities, unpriced congestion impacts, mispriced vehicle insurance and crash externalities, and unpriced environmental impacts.

For example, automobile external costs include 10-50¢ per vehicle-mile for urban roadway capacity and congestion impacts, $5-15 per day for downtown parking (averaging 25-75¢ per vehicle-mile for a 20-mile round trip commute), plus 1-10¢ per vehicle-mile for pollution emissions (see Delucchi, 1996; Murphy and Delucchi, 1998; FHWA, 1997; Litman, 1999 and 2003). This indicates that automobile travel on these corridors costs $0.774 to $1.764 per mile, far higher than light rail subsidies.

This discrepancy is much greater when subsidies are compared per capita, rather than per passenger-mile, since motorists tend to travel far more total miles (about three times as many) than people who rely on public transit for mobility. As a result, the total annual subsidies and external costs of an average motorists is far more than that of a transit user.

In addition, public transit subsidies are partly justified on the following grounds:

- *Equity.* Transit tends to provide basic mobility for non-drivers, many of whom are low income. Subsidies are therefore justified on vertical equity grounds. Since automobile travel is subsidized through general taxes spent on roads and parking facilities, and imposes external costs on other road users (walkers, cyclists and transit users), subsidies can also be justified on vertical equity grounds, as a way for non-drivers to receive a fair share of public resources devoted to transportation.
- *As a second-best strategy to offset another market distortion.* Until automobile transportation is efficiently priced, with congestion fees, road tolls, parking fees, pay-as-you-drive vehicle insurance, and pollution emission fees, transit subsidies can be justified as a way to reduce excessive traffic congestion, roadway costs, parking costs, accident risk and environmental damages.
- *Due to economies of scale.* Rail transit services provide economies of scale, unit costs tend to decline substantially with increased ridership. This price structure justifies subsidies.
- *To help achieve a strategic planning objective.* Rail transit can provide a catalyst for more efficient land use and economic development.

Castelazo and Garrett claim that light rail can only provide short-term congestion and pollution reduction benefits. This is untrue. There is both theoretical and empirical evidence that high quality rail transit can provide significant, long-term reductions in per capita traffic congestion (Lewis and Williams, 1999; STPP, 2001; Litman, 2004b). It does this by attracting discretionary riders (people who have the option of driving for a particular trip), and providing a catalyst for more accessible land use patterns and more diverse transportation systems, which result in overall reductions in per capita vehicle travel. Where grade-separated transit is faster than driving under peak-period conditions, some motorists shift from driving to transit, reducing congestion delays for motorists. As described earlier, cities with well-established rail transit systems tend to have less per capita traffic congest costs, and less per capita pollution emissions than comparable size cities that lack such systems. Note that this benefit is indicated by measuring per capita congestion costs, not delay per vehicle-mile or roadway level of service.

This is not to suggest that the pricing reforms Castelazo and Garrett recommend are unjustified. Like most economists, I agree that the optimal solution to traffic congestion and air pollution is more efficient pricing of automobile travel. With such a system, motorists would pay directly for using roads and parking facilities, and for imposing external costs such as congestion, accident risk and pollution damages imposed on other people. Under urban-peak conditions such fees would be quite high, totalling several additional dollars for a typical downtown commute trip, enough to significantly reduce automobile travel. Such pricing would significantly increase transit demand, increasing its cost effectiveness. Efficient pricing of road use is likely to be more politically acceptable and effective if implemented in conjunction with transit service improvements. The better the travel alternatives available, the smaller the price needed to reduce vehicle use to an economically optimal level (i.e., the greater the elasticity of automobile travel to pricing), and so the smaller the cost imposed on both those who reduce their automobile travel and those who continue to drive.

Providing Mobility for Non-drivers

Castelazo and Garrett argue that it would be cheaper to provide low-income motorists with a car than light rail transit service. This overlooks several important points.

First, transit is subsidized several reasons besides providing mobility to lower-income travelers, including congestion reduction, road and parking facility cost savings, consumer cost savings, increased safety, pollution reduction and support for strategic development objectives. Only a small portion of transit subsidies could efficiently or equitably be shifted to any one of these objectives. If transit subsidies were eliminated and used to purchase cars for 14% of current riders, other transport problems would increase, and the 86% of current transit riders who do not quality would be worse off.

Considering Multiple Objectives

A house serves a variety of functions: sleeping, cooking, eating, entertaining, storage, gardening, etc. Although different households will place different priorities on these functions, few would choose a home based on just one attribute. For example, you would probably not choose a house for its beautiful kitchen if the bedrooms lacked a roof, nor choose a house for its lovely bedroom if the kitchen had no plumbing. Of course, you might choose a house that lacked some function if you knew it could be corrected, but you would not be happy until the problem is resolved.

Similarly, it would be foolish to conclude that a house is unnecessary because one of its many functions could be satisfied more cheaply than paying rent. For example, you would not sell your house and live on the street simply because it would be cheaper to order a pizza every day than to pay rent. A house is much more than just a place to cook.

Yet, Castelazo and Garrett argue that transit service is unnecessary because the money could instead subsidize cars for the portion of users who cannot own a car. Yes, it may be true that this would be cost effective in terms of this one objective, but doing so would leave no resource for addressing other objectives, such as reducing traffic congestion, reducing urban road and parking facility costs, providing mobility for people who for any reason cannot drive, reducing accidents, reducing pollution emissions or supporting strategic land use objectives.

It is fundamentally wrong to suggest that subsidizing car ownership for 14% of current riders can substitute for a transit system. It is equivalent to suggesting that people don't need a home as long as they are provided with free pizzas. That Castelazo and Garrett do not discuss these issues indicates that they do not understand the role of transit as part of a transportation system and are ignoring basic principles for economic evaluation, which require that all benefits and costs be considered.

Second, many transit riders cannot or should not drive. They are too young, disabled, or prohibited from driving. Subsidizing cars instead of transit service would not solve their mobility problems, and would tend to increase higher-risk driving. It is easier to reduce driving by high-risk motorists in communities with good transit systems, for example, by delaying teenage vehicle ownership, revoking driving privileges for dangerous drivers, and reducing vehicle use by elderly residents, which helps explain the much lower per capita traffic fatality rates in areas with good transit service.

Third, substituting car ownership for transit service is probably far more expensive than proponents claim. Eliminating scheduled transit service would force riders who cannot drive to use demand-response or taxi services, which have far higher costs. Cox assumes this could be accommodated by doubling demand-response funding, but since demand response services only provide 1.4% of total transit passenger-miles, doubling its funding could not compensate for reducing the other 98.6% of services. Current carshare services are relatively cheap because they are located in a few suitable urban areas. To provide carsharing in all areas currently served by transit, with enough vehicles to accommodate all peak-period users, could increase unit costs. People tend to significantly increase their travel when they shift from transit to having an automobile, so even if per-mile costs decline, per-user costs would likely increase.

Fourth, increased vehicle traffic on busy urban corridors would significantly increase traffic congestion, road and parking costs, accidents, pollution and other external costs. Castelazo and Garrett misinterpret and underestimate congestion costs. In footnote 3 they calculate that giving 7,700 vehicles to current rail users would increase regional vehicle ownership by 0.5%, which they assume would only increase congestion by 0.5%. But rail users are commuting on the city's most congested corridors, so congestion impacts will be proportionately large. Congestion is a non-linear function: once a roadway reaches capacity even a small volume increase adds significant delays. For example, on an uncongested road, 100 additional vehicles per hour may cause little delay, but adding the same number of vehicles on a road at 90% capacity can increase delays by 20% or more.

For these reasons, shifting 7,700 current St. Louis rail transit riders to automobile commuting is likely to increase regional traffic congestion costs by far more than 0.5%. Although detailed traffic modeling would be needed to determine the exact impact, it is probably five to ten times greater than what Castelazo and Garrett assume. The Texas Transportation Institute calculates that St. Louis traffic congestion costs totaled $738 million in 2001. If 7,700 additional downtown automobile commuters would increase regional traffic congestion costs 2.5% to 5.0%, this represents $18 to $37 million in additional annual congestion costs if just that relatively small portion of total regional transit users shifts to driving.

Fifth, there are substantial practical problems with offering free cars or carshare subsidies to low-income people who currently rely on public transit. Castelazo and Garrett apparently assume that the 7,700 rail transit riders they identify as being unable to afford a car are a distinct, identifiable group. In fact, they consist of a much larger group, many of whom use transit part-time, or who sometimes do not own an automobile. For example, non-car owning riders may consist of 3,000 daily transit users, 4,000 who use it half-time, 10,000 who use it an average of once a week, and 700 out of town visitors. Similarly, some people who do not own a vehicle this month will next month, and vise versa. As a result, rather than giving 7,700 households a car, it would be necessary to offer a much larger number of households a part-time car, with provisions that account for constant changes in vehicle ownership and travel status, and for the increased travel that occurs when non-drivers gain access to an automobile.

Like any subsidy program, it would face substantial administrative costs and require complex rules to determine who receives a subsidy and how much each user is allocated in a way that seems fair and effective at achieving its objectives. It would create perverse incentives, rewarding poverty and automobile dependency.

Finally, as described earlier, transit in general and rail transit in particular can provide a catalyst for mixed-use, walkable urban villages and residential neighborhoods where it is possible to live and participate in normal activities without needing an automobile. This is particularly beneficial to non-drivers. Although these benefits are difficult to quantify, they can be large. This suggests that subsidizing cars rather than transit services provide an additional harm to transportation disadvantaged people, by stimulating urban sprawl and automobile dependency.

Although it may be desirable to make driving more affordable to lower-income people through carsharing, Pay-As-You-Drive vehicle insurance, and even special subsidies to help lower-income households afford car ownership ("Affordability," VTPI, 2004), it is important to avoid oversimplifying the potential of this to substitute for current transit services.

Comparing Transit and Automobile Costs

Castelazo and Garrett make a number of critical errors when comparing transit and automobile costs (See "Common Errors Made When Comparing Transit and Automobile Transport," Litman, 2004b). They ignore many substantial costs resulting with automobile transportation that are reduced when travel shifts to transit, including roadway costs, consumer costs, downstream congestion, parking facility costs, accident costs and pollution impacts. They use *average* cost values that are not representative of the actual costs in the light rail corridor. Light rail systems only exist in dense urban areas, where any form of transportation is expensive to provide. The costs of roads and parking facilities, congestion, air and noise pollution per automobile mile are far higher than average under such conditions.

Castelazo and Garrett claim that light rail operating costs average 54.4¢ per passenger-mile, reflecting national cost values, but this includes many new light rail systems that are still building ridership and so have relatively high costs per passenger-mile. In St. Louis light rail costs actually average 27¢ per passenger-mile, less than a third of the 82¢ per passenger-mile for bus transit services ("Bi-State Development Agency," *National Transit Database*, 2002). Of course, there are many reasons that buses have higher cost per passenger-mile: buses serve lower-density areas where ridership is low, and buses can carry far fewer passengers per driver. However, it is wrong to claim that light rail is more costly than either automobile or bus transport.

On congested urban corridors served by light rail, automobile travel costs far more than the 41.4¢ per passenger-mile Castelazo and Garrett assume. As described earlier, the cost of an automobile trip includes vehicle expenses, 10-50¢ per vehicle-mile for urban road capacity and congestion impacts, $5-15 per day for downtown parking (averaging 25-75¢ per vehicle-mile for a 20-mile round trip commute), plus 1-10¢ per vehicle-mile for pollution emissions (Delucchi, 1996; Murphy and Delucchi, 1998; FHWA, 1997; Litman, 2004b). This indicates that automobile travel on these corridors costs $0.774 to $1.764 per mile, far higher than the costs of light rail transit on the same corridor.

Transit services, particularly rail transit, tend to experience economies of scale: increased ridership reduces costs per passenger-mile or passenger-trip. If some level of transit service must be maintained in order to provide basic mobility to non-drivers, the marginal cost of accommodating additional riders is often small, particularly if the system has additional peak-period capacity. For this reason, arguments that transit is too costly may be an indication that transit deserves *more* rather than *less* support, either in the form of efficient road and parking pricing, or through other incentives.

Of course, there are many corridors where rail transit would be more costly per passenger-mile than automobile travel. Nobody is suggesting that light rail service be provided everywhere. However, on major urban corridors where road and parking facility are costly to construct, and transit demand is high, grade-separated transit is often the most cost effective way to improve transportation, when all costs are considered.

Comparing Bus and Rail Transit

There are often debates over the relative advantages of bus or rail transit. Rail transit critics often argue that rail systems are unnecessarily costly compared with providing the same level of mobility by public transit. However, critics often ignore certain significant advantages of rail transit (Litman, 2004a and 2004b).

First, rail transit it tends to attract more discretionary riders, that is, travelers who have the option of driving, because it is more comfortable and prestigious. Many benefits of transit, such as reduced traffic congestion, road and parking facility costs and pollution emissions, depend on transit's ability to attract discretionary riders. In this way, rail transit systems can provide greater benefits than bus systems. Of course, the choice can be complex, since bus service can be improved in various ways to offer some of the amenities associated with rail, such as grade separation (so buses are not stuck in road traffic), frequent service, more comfortable vehicles, and improved stations. However, this increases bus system costs to be closer to that of rail systems. It is therefore necessary to consider the relative advantages and disadvantages of rail and bus in a particular situation.

Second, on busy corridors rail often costs the same or less per passenger-mile as bus service, since rail systems have large economies of scale. As described earlier, in St. Louis, light rail operating costs average just 27¢ per passenger mile, compared with 82¢ per passenger-mile for bus transport. Although this reflects, in part, the fact that buses serve lower density areas, it would be wrong to claim that rail is always more costly than bus transit, it is necessary to evaluate ridership, costs and benefits on a particular corridor.

Third, rail transit stations tend to be a catalyst for more efficient land use patterns, which reduces per capita vehicle travel and total automobile traffic. This can provide significant benefits, including reduced traffic congestion, road and parking facility cost savings, consumer cost savings, and agglomeration efficiencies that increase economic productivity (these productivity gains are particularly evident in large commercial districts and activity centers such as university campuses and medical centers). This often increases property values in the areas around transit stations, which can result in significant additional property tax revenues. Bus systems do not seem to have the same effect. Although these impacts are difficult to quantify, they can be large, often exceeding the extra cost of a rail transit systems.

This is not to suggest that rail transit is always better than bus transit. The point is simply that these are additional factors that should be considered when evaluating and comparing rail and bus options, which rail critics such as Castelazo and Garrett overlook.

Careless Omissions Or Intentional Bias?

A good research document provides a general overview of current literature on the subject and information that both supports and contradicts (if any exists) the authors conclusions, so readers can make a fair judgment about the issues (Litman, 2004c). Castelazo and Garrett fail to do this. Their report includes general economic concepts, but includes no references to current literature on multi-modal evaluation, or discussion of the full potential benefits of rail transit. This either indicates that they are either ignorant and disinterested in the special issues related to transit evaluation, or that they intentionally wanted to exclude any contradictory ideas.

For example, Castelazo and Garrett fail to reference any of the recent publications on multi-modal evaluation (Cambridge Systematics and Apogee Research, 1996; HLB, 2002; ECONorthwest and PBQD, 2002; DfT, 2003; Litman, 2004b), or any recent studies concerning the full potential benefits of transit (Cambridge Systematics, 1998; Cambridge Systematics, 1999; Litman, 2004a). Referencing such documents would show that they are aware of the various issues and want to present a balanced discussion.

Castelazo and Garrett fail to discuss key analysis decisions and data sources, such as why they use national transit costs (54.4¢ per passenger-mile) rather than local values (27¢ per passenger-mile), how they conclude that only 14% of rail transit riders really depend on the service, or that transit cannot reduce traffic congestion. A good research report describes such assumptions and references data sources, empowering readers to make their own judgments.

Conclusions

There has been considerable debate over the merits of rail transit. Critics argue that it is economically inefficient and more costly than alternatives, but their analysis generally ignores best current practices for transit evaluation, and reflects various inaccuracies, omissions and biases. A recent paper by Molly D. Castelazo and Thomas A. Garrett exhibits typical errors by rail critics. It ignores or understates many benefits of transit, and underestimates the full costs of accommodating additional automobile traffic on rail transit corridors.

Rail transit can improve mobility for non-drivers, reduce automobile travel and associated costs, and support more efficient land use patterns. As a result, communities with major rail transit systems tend to have less per capita traffic congestion, lower per capita traffic fatalities, lower road and parking facility costs, and consumer cost savings. These benefits often exceed rail transit costs.

Critics claim that rail transit is excessively subsidies, but St. Louis light rail transit subsidies are lower than subsidies for bus transport, and far lower than total subsidies and external costs of automobile transport on the same corridor, including traffic congestion imposed on other road users, road and parking facility costs not charged to users, and uncompensated accident and pollution externalities. On the other hand, transit subsidies are justified for the sake of equity, as a second-best strategy to offset another market distortion, due to economies of scale, or to help achieve a strategic planning objective.

Castelazo and Garrett's report fails to reflect current best practices for transit evaluation, reflecting either ignorance of transportation economics, or intentional bias. Although it would not be cost effective to provide light rail transit service everywhere, when all costs and benefits are considered, rail transit is often the most cost effective way to improve transportation on major urban travel corridors.

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