

Comprehensive Evaluation of Rail Transit Benefits

A Comment

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Several recent articles criticize urban rail transit investments on grounds that they are cost ineffective at reducing traffic congestion (Stopher, 2004; Taylor, 2004). Such claims have become so common that they seem to be accepted without question. I would like to challenge this criticism and emphasize the importance of using comprehensive analysis when evaluating transit benefits.

Transit Congestion Reduction Benefits

Contrary to what critics suggest, there is abundant evidence that high quality, grade-separated transit does reduce urban traffic congestion. For example, research by Winston and Langer (2004) indicates that both motorist and truck congestion costs decline in a city as rail transit mileage expands. Garrett (2004) found that traffic congestion growth rates declined in several U.S. cities after light rail service was established. Baum-Snow and Kahn (2005) found significantly lower average commute travel times in areas near rail transit than in otherwise comparable locations that lack rail, due to rails higher travel speeds compared with automobile or bus under the same conditions. Using a regional traffic model Nelson, et al (2006) found that Washington DC's Metro rail transit service generates congestion-reduction benefits that exceed subsidies. My own research (Litman, 2004) shows that per capita congestion delay is significantly lower in cities with high quality rail transit systems than in otherwise comparable cities with little or no rail service. These results hold true even if New York is excluded from the analysis.

Rail transit service reduces congestion costs in three ways.

First, high quality transit service can reduce travel time costs to people who shift mode. Even if there is no time savings measured by a clock, costs per hour tend to be lower than driving if transit service is comfortable (passengers have a seat, vehicles and stations are clean and safe, etc.), allowing passengers to relax and work (“Travel Time Costs,” Litman, 2005). Travelers will choose the mode that best suits their needs and preferences for each trip, maximizing benefits.

Second, grade-separated transit reduces delays on parallel roadways. Urban traffic congestion tends to maintain equilibrium: congestion deters growth in peak-period trips. For example, you might consider trying a new restaurant across town, but decide to wait until later when the road is less congested. Reducing the point of equilibrium is the only way to really reduce long run congestion. The quality of travel alternatives affects this equilibrium. If alternatives are inferior, motorists will be more reluctant to shift mode and more congestion or a higher road toll is needed to reduce traffic volumes. Improving transit service quality reduces the delay or toll needed to reduce automobile trips, which benefits all travelers, including those who continue to drive. Various studies have indeed found that door-to-door travel times for motorists tend to converge with those of grade-separated transit (Mogridge, 1990; Lewis and Williams, 1999; Vuchic, 1999).

Third, rail transit can stimulate transit oriented development (TODs) – compact, mixed-use, walkable urban villages where residents tend to own fewer cars and drive less than if they lived in more automobile-dependent neighborhoods (“Land Use Impacts On Transport,” VTPI, 2005). Although a portion of this effect reflects sorting (people who prefer using alternative modes choose to live in TODs), studies that account for demographics and preferences, and before-and-after studies, indicate that households do significantly reduce their vehicle travel when they move to transit-oriented locations (Frank, Kavage and Litman, 2006). Market surveys indicate that demand for transit oriented development will increase in the future, suggesting that rail transit development can provide significant future benefits (Reconnecting America, 2004).

Critics generally measure congestion impacts in ways that ignore some of these impacts. There are about a dozen different congestion indicators to choose from (“Congestion Costs,” Litman, 2005). Some, such as *roadway level-of-service* and the *travel time index* reflect the intensity of congestion delay to vehicles traveling on a particular roadway, and so fail to account for the benefits to people who shift modes or drive less. Other indicators, such as *per capita congestion delay*, account for these additional impacts, and so tend to recognize greater congestion reduction benefits from rail transit.

Biased Analysis

Rail system expansion generally occurs in large and growing urban areas in response to increasing congestion. As a result, simplistic analysis often shows a positive correlation between rail transit and congestion. Some critics have exploited this relationship to “prove” that rail transit increases congestion (O’Toole, 2004), but their analysis fails to indicate what level of congestion would have occurred without rail.

Rail critics argue that rail transit is not the most cost effective way of reducing traffic congestion, with the implication that traffic congestion is the only significant urban transportation problem. More comprehensive analysis also takes into account other impacts such as parking cost savings, consumer savings, crash reductions, improved mobility for non-drivers, energy conservation, pollution emission reductions, and improved public fitness and health (Table 1). If we ask, “which congestion reduction strategies also help achieve other planning objectives?” roadway capacity expansion generally rates much lower and transit investments generally rate much higher.

Table 1 Rail Transit Benefits (Litman, 2003, 2004)

Benefits	Description
Congestion Reduction	Reduced traffic congestion.
Facility cost savings	Reduced road and parking facility costs.
Consumer savings	Reduced consumer transportation costs.
Transport diversity	Improved transportation options, particularly for non-drivers.
Road safety	Reduced per capita traffic crash rates.
Environmental quality	Reduced pollution emissions and habitat degradation.
Efficient land use	More compact development, reduced sprawl.
Economic development	Efficiencies of agglomeration, increases productivity and wealth.
Community cohesion	Positive interactions among people in a community.
Public health	More physical activity (particularly walking) increases fitness and health.

Rail transit tends to reduce per capita vehicle ownership and use, and encourage more compact, walkable development patterns, which can provide a variety of benefits to society.

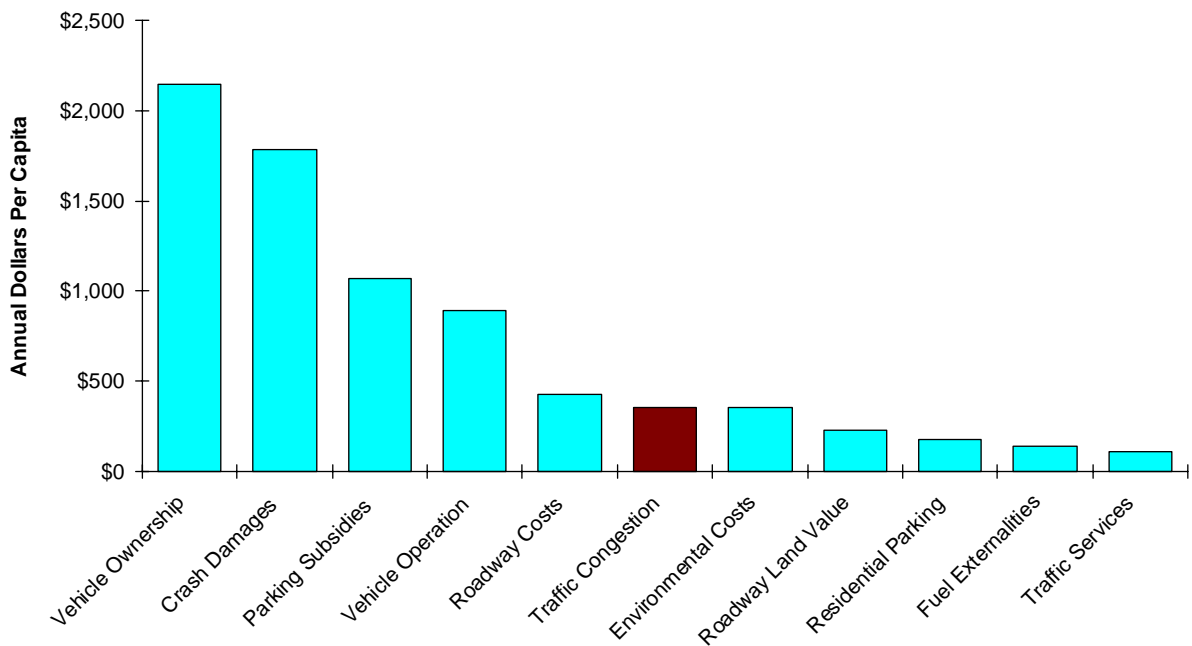
Smart consumers investigate all costs and benefits prior to making a major purchase decision. For example, before buying a car, consumers want accurate information on fuel, maintenance, insurance and repair costs, plus accurate assessments of reliability, comfort and safety of each option. Similarly, communities need accurate and comprehensive information on the full economic, social and environmental impacts of each transportation planning option. As more of these factors are considered, the perceived benefits of rail transit tend to increase. For example, my study found that compared with cities that lack rail, U.S. cities with high quality rail transit systems have (Litman, 2004):

- 400% higher per capita transit ridership (589 versus 118 annual passenger-miles).
- 21% lower per capita motor vehicle mileage (1,958 fewer annual miles).
- 887% higher transit commute mode split (13.4% versus 2.7%).
- 36% lower per capita traffic fatalities (7.5 versus 11.7 annual deaths per 100,000 residents).
- 14% lower per capita consumer transportation expenditures (\$448 average annual savings).

- 19% smaller portion of household budgets devoted to transportation (12.0% versus 14.9%).
- 33% lower transit operating costs per passenger-mile (42¢ versus 63¢).
- 58% higher transit service cost recovery (38% versus 24%).
- Transit-oriented development residents are more likely to achieve recommended levels of physical activity through daily walking than residents of automobile-oriented communities.

Figure 1 illustrates the estimated magnitude of various automobile costs, including vehicle ownership and operation costs, road and parking facilities, traffic services, accidents, environmental damages, and congestion. Congestion costs are relatively modest overall (Litman, 2005). It would not be cost effective to implement a policy that reduces traffic congestion costs by 10% if it increased other transportation costs, such as vehicle expenses, roadway expanses, crashes or environmental damages, by just 3% each. On the other hand, a congestion reduction strategy provides far more benefit to society if it helps reduce these other costs, even by a small amount.

Figure 1 Costs Ranked by Magnitude (“Transportation Costs,” VTPI, 2005)



This figure shows Average Car costs per vehicle mile, ranked by magnitude.

From a household’s perspective, rail transit provides a positive return on investment. Quality rail transit requires on average about \$100 annually per capita in additional tax funding, but provides about \$500 annually per capita in direct consumer transport cost savings. In addition, rail transit tends to increase regional employment, business activity and productivity, plus it improves mobility for non-drivers, reduces the need for motorists to chauffeur non-drivers, improves community livability and improves public health.

Alternative Transportation Improvement Strategies

Of course, critics can legitimately suggest that other strategies may be more cost effective than rail investments. Depending on ideology they may recommend roadway capacity expansion, road pricing, bus transit improvements, or some combination of telework and flextime. These are all legitimate ways of reducing traffic congestion, but they are often complements rather than substitutes for urban rail.

Although, bus transit is excellent for serving dispersed destinations, on major corridors rail tends to be more effective at attracting riders and more cost effective overall, since trains tend to offer a more comfortable ride, are propelled by electric motors rather than internal combustion engines (so train stations tend to be more pleasant than large bus stations), and can carry more passengers per operator. Light rail service has lower operating costs compared to buses with as few as 1,200 peak-period passengers on a corridor, and is particularly appropriate for destinations with more than about 2,000 peak period passenger arrivals to avoid the unpleasant impacts from large congregations of buses at a station (Pushkarev, 1982; Vuchic, 2005).

Critics often claim that bus service is much cheaper to provide than rail, but as performance and comfort features are added (grade separation, larger seats, better stations, alternative fuels, etc.), bus system capital costs increase and approach those of rail, and may be offset over the long run by rail's lower operating costs. My research shows that operating costs are lower and cost recovery is higher in U.S. cities with large rail transit than those with little or no rail service, due to higher load factors and greater operating efficiency (Litman, 2004). Rail stations are far more effective than bus stations at creating TOD and therefore providing the additional benefits associated with improved neighborhood accessibility and reduced pre capita vehicle travel. For these reasons, where ridership volumes are high and transit oriented development is a major planning objective, rail may be justified despite higher initial costs.

Road pricing can reduce urban traffic congestion and eliminating the need for grade separated busways, but most cities that have implemented urban road pricing (Singapore, London and Stockholm) have rail transit, which accommodates the large numbers of transit passengers that pricing creates. By providing an attractive travel alternative, rail transit reduces the price needed to reduce traffic congestion, benefiting motorists and making rail transit a complement to congestion pricing.

This is not to say that every rail transit project is optimal or that transit investments alone will solve every transportation problem. However, a variety of studies indicate that considering all impacts and planning objectives, rail transit is often a cost effective investment.

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