Victoria Transport Policy Institute
"Efficiency - Equity - Clarity"

1250 Rudlin Street, Victoria, BC, V8V 3R7, CANADA
www.vtpi.org   info@vtpi.org
Phone & Fax 250-360-1560

Evaluating Rail Transit Criticism

4 November 2004

Todd Litman
Victoria Transport Policy Institute

Abstract
This report evaluates criticism of rail transit. It examines claims that rail transit is ineffective at improving transportation system performance, that rail transit investments are not cost effective, and that transit is an outdated form of transportation. It finds that critics often misrepresent issues and use biased and inaccurate analysis. This is a companion to the report "Rail Transit in America: A Comprehensive Evaluation of Benefits."

Contents

Introduction

In recent years many cities have made, or are considering, rail transit investments. Some critics argue that rail transit is ineffective, wasteful and outdated. This report examines these criticisms. It evaluates critics' arguments, analysis and conclusions.

Rail transit is not appropriate in every situation, and even the best transit program can be improved. Rail transit supporters therefore welcome legitimate criticism that helps identify possible problems and opportunities for improvement. However, some transit criticism is unhelpful because it is based on inaccurate claims and biased analysis. It is therefore helpful to evaluate rail transit criticisms to discern legitimate and helpful analysis from errors and misrepresentations.

Certain practices indicate research quality (Litman, 2004b). A good research document provides readers with the information they need to make an informed assessment of an issue, including discussion of differing perspectives and evaluation methods, and information that both supports and contradicts (if any exists) the authors conclusions. Many transit studies do this, providing accurate and useful analysis.

But some critics fail to use best practices for accurate transit evaluation. They provide inaccurate information and biased analysis intended to present rail transit in a negative way. They ignoring other perspectives, and suppress data that contradict their arguments. These critics tend to consider a relatively limited set of transit impacts, as summarized in Table 1. As a result, they tend to understate the full benefits of transit.

Table 1 **Impacts Considered and Overlooked** (Litman, 2004a)

Usually Considered	Often Overlooked
Financial costs to governments	Downstream congestion impacts
Vehicle operating costs (fuel, tolls, tire wear)	Parking costs
Travel time (reduced congestion)	Vehicle ownership costs (depreciation, insurance, etc.)
Per-mile crash risk	Impacts on non-motorized travel
Project construction environmental impacts	Project construction traffic delays
	Impacts of generated traffic
	Indirect environmental impacts
	Strategic land use impacts
	Equity impacts
	Per-capita crash risk
	Impacts on physical activity and public health

Older transportation evaluation models tended to focus on a limited set of impacts, which tends to undervalue transit services and improvements.

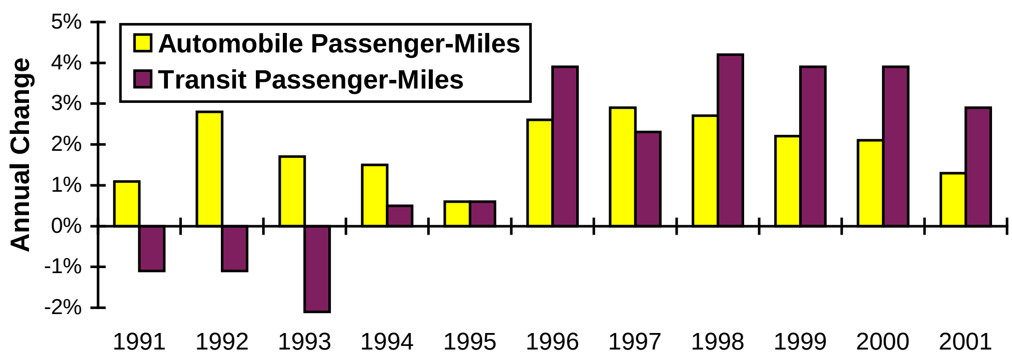
Rail transit tends to create more accessible land use patterns and more diverse transport systems, which reduce per capita vehicle ownership and mileage, thereby providing additional benefits in terms of reduced congestion, road and parking facility costs, consumer costs, accidents and pollution emissions, and improved mobility for non-drivers. Critics often overlook these impacts and so understate total rail benefits.

Role of Transit in a Modern Transportation System

Critics sometimes claim that transit is outdated, of little importance in a modern transportation system. For many decades automobile use (here "automobile" includes cars, light trucks, vans and SUVs) grew, while transit declined in 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. For example, the Institute of Transportation Engineers (ITE, 2003), the International City/County Management Association (ICCMA, 1998) and the American Governor's Association (Hirschhorn, 2001) all support smart growth planning objectives and evaluation methods, and these have been widely adopted at the regional and local level. As a result, communities are better able to create transit oriented developments which take advantage of transit benefits.
- 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.
- Several demographic, economic and consumer preference trends (smaller households, more elderly people, increased popularity of urban loft apartments, increased value placed on walkability, etc.) support urban redevelopment and increased use of transit.
- In many growing metropolitan areas the most convenient suburban areas have already been developed. Further suburban expansion is more costly, both to households and society, making infill development increasingly attractive.

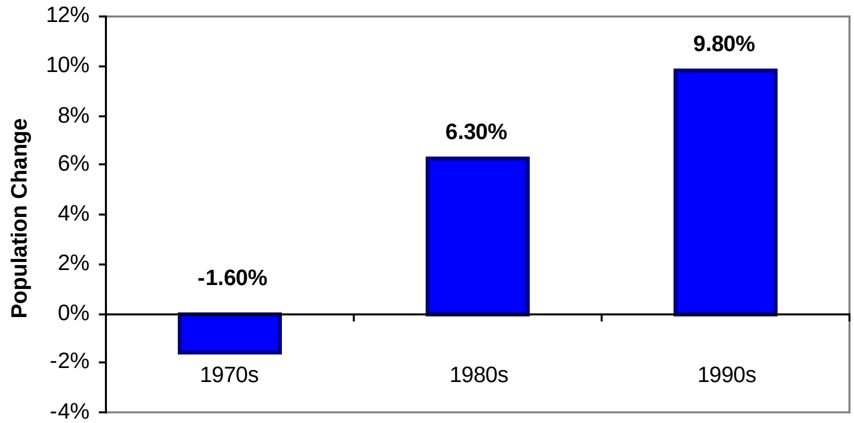
Figure 1 **Highway and Transit Travel Trends** (BTS, 2003, Table 1-34)



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

From the 1950s through the 1990s several trends were against transit, but many of these trends have peaked. During this period per capita vehicle ownership and mileage, roadway mileage, and suburban dispersion all grew, increasing automobile use and reducing transit travel, but each of these factors have leveled off or declined in recent years. The baby boom's peak driving years are over. The real price of fuel, which declined for most of the last century, is expected to increase in the future as production peaks. Since the mid-1990s transit ridership has increased and many U.S. cities have experienced population growth, as indicated in figures 1 and 2.

Figure 2 **50 Largest U.S. Cities Growth Trends** (U.S. Census Bureau)



City populations declined during the 1950s through the 1970s, but since then have grown. This indicates that many people like urban living. Many current trends support more urban growth.

Well designed and maintained roads are critical to any transportation system. They are essential most 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 not 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. Rail 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.

Critiquing Rail Transit Critics

This section examines in detail claims made by several rail transit critics.

"Great Rail Disasters" *(O'Toole, 2004)*

Great Rail Disasters is one of several documents by Randal O'Toole that argue against rail transit investments and other smart growth policies.[1] It uses a thirteen component index created by the author to evaluate rail transit system performance. This index fails to reflect best practices transit evaluation.[2] Rather, it appears to be carefully designed to portray rail transit in a negative way.

This analysis makes a fundamental error by lumping all rail systems together, although some are new and small, and so cannot be expected to significantly affect regional transport patterns. Accurate analysis must take into account the relative magnitude of rail systems, or compare areas with and without transit service within a city (Litman, 2004a).

Great Rail Disasters claims that rail fails to attract transit ridership, based on changes in the portion of total regional travel made by transit between 1970 and 2000 in individual cities. But, transit ridership grew in 18 of the 23 cities, particularly those with expanding rail systems such as Denver (40%), Los Angeles (14%), Portland (59%), Sacramento (48%), San Jose (23%) and St. Louis (22%), indicating that rail transit investments do increase ridership. It is arbitrary to claim that rail is a failure simply because ridership grows slower than population or automobile trips. Because the study includes no comparisons between cities with and without rail, or between cities and national trends, the analysis indicates nothing about what would have happened without rail.

The report analyzes a period during which several factors increased automobile travel and reduced transit ridership, including increasing vehicle ownership, the baby boom reaching peak driving age, more women in the workforce, and declining transit service. Transit commute mode share declined from 8.4% in 1969 to 4.7% in 1977, but held steady at 5-6% from 1983 through 1995, and increased since 1996 (Figure 1).

Great Rail Disasters claims that rail is not cost effective, by comparing roadway and rail capacity expansion costs. This is inappropriate for several reasons. First, O'Toole's report only takes into account a small portion of automobile costs and transit benefits when comparing modes and evaluating cost effectiveness. He overlooks the cost of owning and operating automobiles, the cost of providing parking at destinations, and other external costs such as accident risk and pollution emissions, all costs that are reduced when people travel by transit. In other words, rail systems include vehicles, track and parking facilities, so these costs should be considered in the analysis. He also overlooks the benefit of providing mobility for non-drivers, and of urban redevelopment and associated property value increases near transit stations.

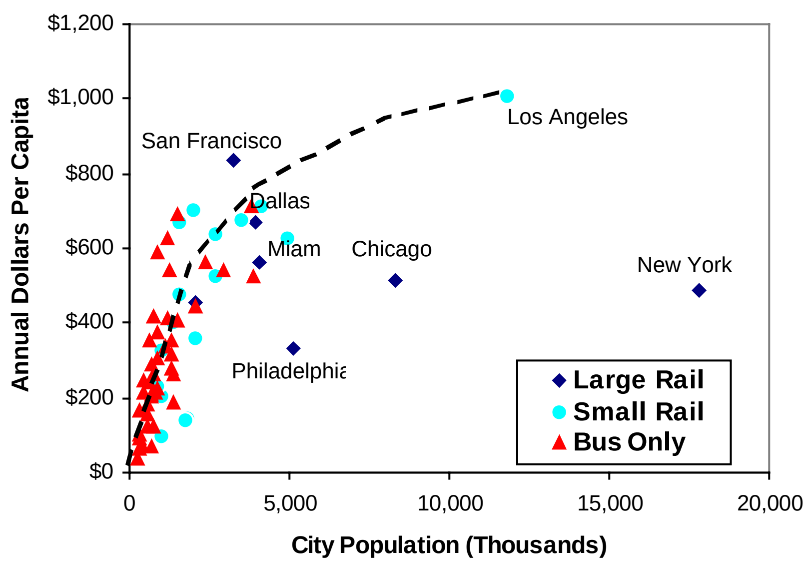
O'Toole significantly underestimates the real cost of roadway capacity expansion in congested urban areas. Although he may be correct that freeway construction costs average $5 to $10 million per lane mile, this does not include the costs of planning, land acquisition, or intersection reconstruction. Current urban highway projects are typically $20 to $40 million per lane mile.

The analysis is also wrong to compare road and rail based on daily travel rather than peak period travel. Urban roadways are sufficient to handle travel demand most times of the day, accurate economic analysis recognizes that roadway capacity expansion is needed to accommodate peak demand, so the costs should be assigned to peak-period travelers. The correct question is therefore, which option is most cost effective for accommodating additional *peak period* travel, taking into account all costs, including vehicles,

Great Rail Disasters claims that rail increases traffic congestion, because all rail cities experienced congestion increases between 1982 and 2001 as measured by changes in the Texas Transportation Institute (TTI) *Travel Time Index* and per capita vehicle travel. But this indicator is inappropriate for evaluating transit congestion impacts since it does not account for the reduction in congestion delays that occurs when people shift from driving to grade-separated transit, or when transit oriented development improves accessibility and reduces the need to travel. Since the report does not compare cities with and without rail, nor rail cities with national trends, nor does it account for city size, it provides no information on the amount of congestion that would occur if rail did not exist.

Several studies find that rail transit does provide substantial congestion reduction benefits (Lewis and Williams, 1999; Bento, et al., 2004; Litman, 2004a; Litman, 2004b; Winston and Langer, 2004). Special care is needed to accurately evaluate these impacts. Traffic congestion tends to increase with city size because there are more vehicles within a given area. Rail transit systems are generally developed as cities grow large enough to experience significant congestion problems, so cities with rail transit tend to have worse congestion than those without, but it is wrong to suggest that rail transit *causes* congestion, or that congestion problems would be as bad if rail transit did not exist.

Figure 3 **Congestion Costs** (TTI, 2003)



In cities with small or no rail systems, traffic congestion costs tends 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.

The Texas Transportation Institute's annual *Urban Mobility Study* is the standard reference for comparing congestion in U.S. cities. It provides seven congestion indicators. Some are more appropriate than others for evaluating transit impacts. *Per-capita Congestion Cost* is a better indicator of transit congestion reduction benefits, since it accounts for time savings that result from shifts to alternative modes and more accessible land use patterns. Measured in this way, Large Rail cities have substantially less congestion than other comparable size cities, as illustrated in Figure 3.

Great Rail Disasters argues that rail transit is dangerous because of high crash rates per passenger-mile. However, per capita traffic deaths is a better indicator of traffic safety, and as described earlier in this report, Large Rail cities have significantly lower per capita traffic fatality rates indicating substantial safety benefits. Cities with large rail systems average 7.5 traffic fatalities per 100,000 population (7.9 excluding New York), while cities with smaller rail systems average 9.9, and cities that lack rail average 11.7, a 40% higher rate (Litman, 2004a).

Great Rail Disasters claims that rail is more costly than bus or automobile transport, but that claim is based on faulty analysis. Rail transit usually has lower costs per passenger-mile than bus transit, and comparisons between rail and automobile fail to account for the full costs of accommodating additional peak-period motor vehicle traffic on the crowded urban corridors served by rail, taking into account vehicle, roadway and parking costs. When comparing transit and highway carrying capacity it uses daily travel data, rather than peak-period data as accurate analysis would require, since increased peak-period vehicle travel requires additional roadway capacity, but off-peak travel does not.

Great Rail Disasters argues that rail transit negatively impacts overall transit ridership by absorbing an excessive portion of transit funding, but per capita funding for both rail and bus transit tends to increase as rail transit systems expand, indicating that rail and bus transit are complements, not substitutes. This indicates that investing in rail improves bus service over the long-term. In addition, transit oriented development tends to provide other benefits to non-drivers, including improved walking and cycling conditions, and less dispersed destinations that are easier to access without a car.

Great Rail Disasters claims that rail transit projects are consistently over-budget and have lower ridership than projected, based primarily on a study performed in the late 1980s that used five to ten year old case studies (Pickrell, 1989 and 1992). Even when describing examples two decades old, *Great Rail Disasters* uses the present tense (e.g., "Pickrell reports that it went 61 percent over budget and carries less than a third of the anticipated riders"). Even when it was first published Pickrell's report was considered dated, since planning reforms had already corrected many of the problems identified (APTA, 1990). Much of what Pickrell classified as cost overruns where actually anticipated adjustments due to design changes. Similarly, it reports fourteen-year-old data on airport rail transit use by air travelers, and only when this number is low.

Great Rail Disasters provides estimates of cost overruns and rider shortfalls for various rail projects, but includes no details. Researchers normally provide specific references and analysis in a report to allow independent verification. O'Toole's failure to provide this information indicates either carelessness or that he has something to hide.[3] Many recent rail systems have been built within or close to projected budgets, and have had higher than expected ridership, such as Salt Lake City, Denver and St. Louis.[4]

Denver's New Light Rail Succeeds at Attracting Riders
About 32% more riders are boarding Denver, Colorado's new southwest light-rail line than the transit agency projected would use the new line during its first year. "The trains are so packed by the time they reach the northern stations you have to wait 20 minutes or more to catch the next train," says one rider. Light rail's popularity since the line opened July 14, 2000 has forced into service every car the transit agency has, including the four cars reserved for emergencies, maintenance rotations, and breakdowns. "They're standing on top of each other," says a 35-year-old rider. "They're standing in the doorways. They'll do anything to squeeze onto the train."

Many highway projects also cost more than originally projected, or fail to reduce traffic congestion as expected. A General Accounting Office report (GAO, 2003) found that 23 of 30 major roadway projects had costs exceeding projections. In 2001, Virginia's Legislative Audit and Review Commission found that state transport project costs were well above original estimates due to expanded scope, failure to consider unexpected costs, and design errors, increasing the state's transportation development plan costs by 40% over its original budget. Similarly, many toll roads have less than projected traffic and revenue (GAO, 2004). Muller (2001) found that of 16 recent U.S. toll road projects, demand and revenues averaged only 50-60% of forecasts. These examples show that highway projects are as vulnerable to inaccurate projections as transit projects.

Great Rail Disasters states incorrectly (and without citation) that regions with rail system devote 30-80% of their total transportation capital budgets on transit. Rail transit actually represents a small portion of total transport expenditures. In 2000 rail transit subsidies (expenditures minus fares) totaled $12.5 billion, compared with $103 billion spent on roads and an estimated $200 billion spent on non-residential parking facilities. Rail subsidies therefore represent less than 10% of total roadway and transit expenditures, and less than 5% of roads, transit and parking facility expenditures. Current rail transit projects often seem large because:

- New transit projects must overcome decades of underinvestment in grade-separated transit.
- Transit must provide a high quality of service to attract discretionary riders out of their cars.
- Rail transit is generally constructed in the densest part of a city where any transportation project is costly, due to high land values, numerous design constraints, and many impacts.
- Rail transit projects often include special amenities such community redevelopment and streetscape improvements which provide additional benefits, besides just mobility.
- Rail transit projects include tracks, trains, stations, and sometimes parking facilities, so it is inappropriate to compare rail system costs with just the cost of adding roadway capacity.

When a major rail transit project is under construction most of the cost is included in a particular transportation agency's capital budget, so for a few years it appears relatively large, but when averaged over a larger time period (rail transit capital investments have 20-50 year operating lives), or over several cities, transit capital projects represent a small portion of total government transportation expenditures.

Great Rail Disasters claims that rail transit uses more energy than automobile travel, and is a costly way to reduce pollution emissions. However, it compares transit energy consumption with passenger cars (3,500 BTUs per passenger-mile) rather than the weighted average of automobiles (6,348 BTUs per passenger-mile), including light trucks, SUVs and vans. It fails to account for rail's ability to reduce per capita vehicle travel and therefore emissions. Although rail may be more costly than other emission reduction strategies, it can be cost effective when all benefits and costs are taken into account. Energy and emission reductions may be considered a co-benefit of these other objectives. For example, if a community is choosing between expanding roadway and parking capacity, or building rail in order to reduce traffic congestion and parking problems, it makes sense to favor the rail option if it also reduces energy consumption and pollution emissions.

Great Rail Disasters claims that transit oriented development reduces housing affordability, but this depends on how affordability is measured (Arigoni, 2001; Nelson, et al, 2002). Analysis is complicated because rail transit projects are generally implemented in rapidly growing cities where property values are rising due to increasing demand. Studies may show an association between rail transit or growth management policies and reduced housing affordability, but that does not indicate that they *cause* reduced housing affordability.

Great Rail Disasters argues that zoning and other land use controls reduce housing affordability. This may be true, but the worst of these costs are minimum parking requirements and density restrictions to support automobile travel. Shoup (1999) found that parking costs average 4.4 times all other development charges combined, including fees for roads, schools, parks, water, sewage and flood control. Reducing parking requirements, increased housing diversity (allowing more multi-family developments and secondary suites), and location efficient development (which reduces household transport costs) are smart growth ways to increase household affordability (Jia and Wachs, 1998; McCann, 2000; Arigoni, 2001; "Location Efficient Development," VTPI, 2004). Residents of Large Rail systems tend to spend significantly less on transportation, indicating that rail investments can increase household affordability (Litman, 2004b).

Great Rail Disasters' bias is revealed in its analysis of Portland, Oregon. According to many of its own indicators Portland's rail system is successful, with increasing transit ridership and commute mode split. Still, O'Toole concludes that Portland's rail system is harmful because it involves smart growth, and he favors automobile-oriented sprawl. O'Toole argues that smart growth harms consumers. Yet, there is plenty of evidence that smart growth can provide significant consumer benefits, and many consumers prefer living in transit oriented communities (ICCMA, 1998; Litman, 2003b).

Summary: The Data Say Ouch!

Any evaluation involves numerous decisions as to which data to use, how to analyze them, which results to include, and how to present them. Statisticians joke that a researcher who manipulates analysis to reach a preferred conclusions "tortures the data."

For example, consider congestion impact analysis. The Texas Transportation Institute's *Urban Mobility Study* has nine congestion indicators. Of these, the Travel Time Index is the least appropriate for evaluating grade-separated transit since it only considers delays to road vehicles. Using this rather than *per capita* congestion costs indicates ignorance or intentional bias. In addition, data can be evaluated in various ways. Should cities with rail be compared with those that lack rail, and if so, which ones? Should analysis consider a single point in time or trends over time, and if so, which time periods? Should individual cities be compared with national trends? Should results be presented in total or per capita? A clever analyst can usually find a combination of data and evaluation techniques that reflect the conclusion they want. The results are true but biased.

Several features of the analysis presented in *Great Rail Disasters* violate standard evaluation practices, indicating that the data were selected and analysis manipulated to support the author's desired conclusions.[5] These include:

- Lack of with-and-without analysis. There are virtually no comparisons between cities that have rail and those that do not. It is therefore impossible to identify rail transit impacts.
- Failing to differentiate between cities with relatively large, well-established rail systems and those with smaller and newer systems that cannot be expected to have significant impacts on regional transportation performance (total transit ridership, congestion, etc.).
- Failing to compare individual city's trends with national trends.
- Failing to account for additional factors that affect transportation and urban development conditions, such as city size, changes in population and employment.
- Failing to apply marginal analysis. The report makes no effort to determine the incremental cost of accommodating additional peak-period travel by each mode.
- Ignoring significant costs. Vehicle expenses are included when calculating transit costs, but vehicle and parking expenses are ignored when calculating automobile costs.
- Exaggerating transit development costs. Claims, such as "Regions that emphasize rail transit typically spend 30 to 80 percent of their transportation capital budgets on transit" are unverified and generally only true for certain regions and years, not when costs are averaged over larger areas and times.
- Presenting outdated data as current, including examples from the 1960s through early 80's, and airport ridership data from 1990.
- Ignoring other benefits of rail transit, such as parking cost savings, consumer cost savings and increased property values in areas with rail transit systems.
- Failing to reference documents that reflect current best practices in transit evaluation, such as ECONorthwest and PBQD (2002) or Litman (2004) or provide any information showing alternative perspectives.

Evaluating the Index

The Rail Transit Performance Index used in *Great Rail Disasters* is biased and ineffective. The table below describes changes that would be needed to make it more accurate.

Table 2 **Rail Transit Performance Index**

"Great Rail Disaster" Indicators	Required For Accurate Analysis
1. Change in transit ridership from 1990 to 2000.	Rail systems should be categorized by their size relative to total transit ridership. Analysis should focus on the corridors served by rail, not total regional transit ridership. Should compare with national ridership trends. Continue to use most recent available data, such as 2002.
2. Change in transit share of motorized passenger travel from 1990 to 2000.	"
3. Change in transit commuting in the 1990s.	"
4. Change in transit's share of commuting in the 1990s.	"
5. Reliability of construction cost forecasts.	Categorize by year (e.g., pre-1990, 1990-1999 and 2000+) to see if predictions improved over time. Provide specific citations to allow independent verification.
6. Reliability of ridership forecasts.	"
7. Changes in congestion from 1982 to 2001.	Categorize rail systems by relative size. Use per capita congestion costs rather than a congestion index (which treats increased driving as a congestion-reduction strategy). Analyze individual rail corridors rather than total regional congestion.
8. Changes in per capita driving from 1982 to 2001.	Categorize rail systems by relative size. Analyze corridors served by rail. Compare with national trends. Continue to use most recent data, such as 2002.
9. Cost effectiveness of rail transit relative to freeways.	Categorize rail systems by relative size. Analysis marginal rather than average costs, taking into account facility, parking and vehicle costs.
10. Cost effectiveness of rail transit relative to buses.	Categorize rail systems by relative size. Compare marginal rather than average costs.
11. Safety of rail relative to autos and buses between 1992 and 2001.	Categorize rail systems by relative size. Compare *per-capita* traffic fatalities, to account for the leverage effect rail can have on per capita vehicle travel.
12. Energy efficiency of rail relative to passenger cars in 2002.	Categorize rail systems by relative size. Compare *per capita* transport energy use, to account for the leverage effect that rail can have on per capita vehicle travel.
13. Effects of rail transit on land-use regulation and property rights.	Recognize that many householders prefer to live in more multi-modal neighborhoods, and that TOD reduces many land use regulations, such as parking requirements, setbacks and density limits.

This table recommends more appropriate indicators of transit system performance.

Point and Counter-Point With O'Toole

The week after this critique was released Randal O'Toole responded to it. Below are his comments and my responses (in italics).

1. NEW YORK DISTORTS DATA

O'Toole: I like to say that the U.S. has two kinds of urban areas: New York and everywhere else. Nowhere else has a Manhattan with 52,000 people per square mile and (more important) 80,000 jobs per square mile. New York transit has more than twice the market share of the next leading region. Lumping New York in the transit data for any other group of urban areas (as you do in your discussion of "Large Rail cities" and elsewhere in your report) produces distorted results that are not reflective of other regions. Because New York is so large and because it produces more than 5 times as many transit rides as the next-highest urban area (and 38 percent of all transit rides in the U.S.), the averages you get from lumping it with other regions will be unrealistically high for any other region.

Litman: I recalculated the data (www.vtpi.org/rail.xls) to exclude New York. Below are examples to illustrate the point. In each case, excluding New York reduces the advantage of Large Rail cities by a modest amount, indicating that other Large Rail cities also enjoy significant benefits.

Annual Per Capita Transit Trips	Large Rail	Small Rail	Bus Only
50 largest U.S. Cities With New York	589	176	118
50 largest U.S. Cities W/O New York	520	176	118

Annual Traffic Fatalities Per 100,000 Pop.	Large Rail	Small Rail	Bus Only
50 largest U.S. Cities With New York	7.46	9.99	11.72
50 largest U.S. Cities W/O New York	7.90	9.99	11.72

Per Capita Annual Congestion Costs	Large Rail	Small Rail	Bus Only
50 largest U.S. Cities With New York	$551	$466	$397
50 largest U.S. Cities W/O New York	$561	$466	$397

Percent Income On Household Expenditures	Large Rail	Small Rail	Bus Only
50 largest U.S. Cities With New York	12.04%	15.81%	14.89%
50 largest U.S. Cities W/O New York	12.02%	15.81%	14.89%

Similarly, the other six "Large Rail cities" are all older cities with high-density cores that have not been built elsewhere in the last century. While it is amazing that these regions have such low transit ridership compared with New York, any results for these six regions cannot be applied to newer regions such as Atlanta, Phoenix, and San Jose. These newer regions are just never going to look like Chicago or San Francisco. This is why I compared each region individually and didn't try to lump them together.

Litman: That is a key issue discussed in my paper, that is, whether new rail systems can achieve the land use impacts of older rail systems (see "Counter Arguments"). The evidence indicates it can, provided it is supported with appropriate transport and land use policies. The question is not whether Atlanta can become Chicago, but whether some Atlanta neighborhoods can become like some Chicago neighborhoods, and whether rail projects that leverage such land use patterns provide more benefits than alternative transport improvements on that corridor.

O'Toole misrepresents his paper when he says it does not try to lump cities with rail transit together. His report claims that, "The twenty-three urban areas with rail transit collectively lost more than 33,000 transit commuters during the 1990s, while the twenty-five largest urban areas without rail transit collectively gained more than 27,000 transit commuters." *Not only is this an example of a broad statement comparing rail and non-rail cities, but he admitted to me more than a month ago that the numbers are incorrect (it should be a 14,097 loss in rail cities and a 1,388 gain in bus cities), yet he has not changed the wording of the reports posted on his website.*

2. PER CAPITA TRANSIT RIDERSHIP IS NOT AN INDICATOR OF LIVABILITY
O'Toole: Much of your report focuses on the allegedly high per capita transit ridership in rail regions. But why is this important? Even the fastest transit tends to be slower and (because it is not door-to-door) less convenient than the automobile. High levels of per capita ridership thus suggest lower levels of mobility. Perhaps this is because the city is so well designed that people don't need that mobility -- the Robert Cervero argument for accessibility rather than mobility. In fact, no urban area, with the possible exception of New York (really, only parts of New York) is designed to give people accessibility through transit. This means that high levels of per capita transit ridership probably mean lower levels of mobility, which in turn means higher housing costs, consumer costs, and other costs.

Litman: I agree that transit ridership is an objective, not a goal. The goal is to improve transport system performance and provide consumer benefits. Most urban mobility is a derived demand, to provide access to goods, services and activities. Few people drive across town during rush hour just for the fun of it. Relative speed is just one aspect of access, some people prefer commuting by transit, particularly rail, because it is less stressful than driving, even if it takes more time. O'Toole evaluates transport system performance only in terms of mobility, not accessibility, and therefore ignores benefits that result when transit provides a catalyst for more accessible land use patterns. For more information see "Measuring Transportation: Traffic, Mobility and Accessibility", published last year in the ITE Journal (www.vtpi.org/measure.pdf), which discusses differences between mobility and accessibility.

I don't claim that every rail project significantly increases land use accessibility or that only rail transit investments can achieve these changes, but the study suggests that when such changes occur they can provide large benefits, including benefits to people who do not currently ride transit. Even relatively modest increases in transit mode split can cause relatively large per capita transport cost savings, congestion reductions and traffic death reductions. I think this occurs because the regional data hide larger local impacts, and shifts from automobile to transit tend to occur where it provides the greatest benefit (i.e., peak-period travel to major centers).

O'Toole is wrong to claim that transit oriented development and smart growth reduce housing affordability (See Arigoni, 2001; Nelson, et al., 2002; Carman, Bluestone and White, 2003). In some ways they reduce it (reduced per capita land supply) and in other ways they increase housing affordability (increased density allowances, more diverse housing options, reduced building setback requirements, reduced per capita parking costs, transportation costs, infrastructure cost savings that reduce taxes and business costs, etc.). This study indicates that residents of cities with large, well-established rail systems spend significantly less on transportation than residents of other types of cities, providing significant additional cost savings to smart growth community residents. These values change little when New York is excluded.

3. THE REPORT EMPHASIZES POINTS IN TIME WITHOUT SCRUTINIZING TRENDS
O'Toole: Most of the indicators in Great Rail Disasters were trends: typically 1990 to 2000. Most of the indicators in your report represent single points in time. Rail regions, for example, may have high per capita transit ridership, but if transit commuting is declining while it is increasing in bus regions, then that high ridership is pretty meaningless. Rail cities may have slightly lower per capita driving, but if per capita driving is increasing faster in those cities, it will not do them much good. Of your "large rail cities," Boston is the only one that is showing much transit growth. Of your "small rail cities," Portland and, to a lesser degree, San Diego are the only ones showing much transit growth. That is hardly indicative of rail's great success.

Litman: Simply tracking ridership trends indicates little about the effects of rail, since there is nothing to show how trends would differ without rail. Comparisons between cities with and without rail, or between rail cities and national trends, provide more useful information. I agree that low transit ridership is a reason for concern, but I don't think it proves that rail is necessarily a failure or a bad investment. Various cost-effective strategies described in my report can increase transit ridership and attract discretionary riders. The question therefore shifts from whether transit is good or bad, to how to optimize transit benefits. The concerns O'Toole raises can therefore justify MORE rather than LESS support for rail, provided they are cost effective.

4. RAIL COST EFFECTIVENESS IS GREATLY OVERESTIMATED
O'Toole: The report says that "rail transit is generally constructed in the densest part of a city where capacity expansion is most costly." It is equally true that rail transit is generally constructed in the slowest growing part of a city where capacity expansion is least needed. In any case, we have several examples of parallel rail and highway construction where the rail cost per passenger mile was far greater than the highway cost. Table 4 of your analysis compares user costs without mentioning the huge subsidies for rail transit. Through gas taxes, U.S. highways pay for themselves. Total subsidies to auto users are little more than 0.3¢ per passenger mile. Subsidies to the average transit rider are around 60¢ per passenger mile, and subsidies to rail riders are greater. Your analysis also compares operating costs, when in fact capital costs (when annualized using a standard amortization formula as required by the FTA) greatly outweigh operating costs for rail transit. That is like comparing the costs of housing but leaving out the costs of the walls and roof!

Litman: My goal is to create a comprehensive and accurate evaluation framework (see Litman, 2004a). Rail project budgets incorporate all associated costs. Buses require highways; and automobile travel requires vehicles, highways and parking facilities. It is inappropriate to compare rail capital costs with bus or highway costs without considering all vehicle, roadway and parking costs. I will incorporate capital costs in future analysis.

5. HOUSING AFFORDABILITY DISCUSSION WRONG
The report says that "rail transit projects and smart growth policies are generally implemented in rapidly growing cities where property values are rising due to increasing demand." That is not necessarily true. The fastest growing cities in the U.S. have no rail transit and little smart-growth planning and their housing remains very affordable. It is only in cities such as San Jose and Portland, where planners have attempted to create a transit utopia by increasing population densities that housing prices have become dramatically unaffordable.

Todd Litman: As described above, smart growth and transit-oriented development can increase overall housing and transportation affordability by reducing various costs.

6. SAFETY DISCUSSION USES WRONG MEASURE
O'Toole: I compared the safety of various forms of transport in terms of fatalities per passenger mile. You compare it in terms of fatalities per capita. If it is true that smaller cities have higher per capita driving, then they can have lower fatalities per passenger mile yet higher fatalities per capita. Which is the right measure? If you value mobility, as I do, then fatalities per passenger mile is the correct measure. Though regrettable, fatalities result from almost anything we do. The question is whether what we do is worth the risk. Is getting to work on time worth the tiny and declining risk of getting killed in traffic? Apparently it is because most people drive. If you don't value mobility, then fatalities per capita may be adequate. But then you have to ask what the people in your smaller rail and bus cities are getting for their mobility. I suspect they are getting lower housing prices and other consumer costs, a wider range of job opportunities, access to more recreation, etc.

Litman: As mentioned above, most urban mobility is a derived demand, not an end in itself. Few people want to live in a community that requires more driving, requires more vehicle cost and causes more traffic deaths if they can enjoy a similar level of accessibility without these problems. Large Rail cities tend to have higher average incomes, suggesting more rather than less access to employment options and higher levels of productivity.

7. THE COST OF SPRAWL IS EXAGGERATED
O'Toole: Your report says that I "favor automobile-oriented sprawl." Nothing could be further from the truth. I favor freedom of choice and I oppose government manipulation of people to get some predefined (and ineptly designed) goal.

Litman: Minimum parking requirements, single-use zoning, restrictions on density and multi-family housing, building setbacks, generous road standards and many other current policies support sprawl and automobile dependency, yet O'Toole only opposes regulations that support transit. Analysis by Shoup described earlier indicate that parking costs are 4.4 times higher than other development fees.

O'Toole: Cities without zoning (e.g. Houston) have demonstrated that, in the absence of regulation, people prefer to drive and to live in low-density, single-use developments. Cities with high degrees of regulation and restrictions on driving and low-density development (e.g., Paris, Amsterdam, and almost any other major European city) show that people still prefer to live in low densities and to drive, as driving is rapidly increasing and densities declining in almost all European cities.

Litman: The evidence is quite mixed, and it misrepresents the issue to claim that it proves any single thing. People are diverse and at least some prefer urban living. Many cities are now experiencing population growth. Residents of Houston now support development of alternative travel options, including HOV lanes, bus transit, and recently rail transit systems, because they know from experience the problems that result from excessive dependency on automobiles, and therefore the benefits from a more diverse transportation system. This is not a question of urban versus suburban growth, rather, it is the nature of the growth that occurs since suburbs can be transit oriented.[6] Studies described in my paper indicate that many households are willing to pay a premium for New Urbanist housing and proximity to rail transit. Whether this market segment is a minority or a majority of consumers is irrelevant, as long as there is a sufficient demand (15-25% of urban households), it is large enough to support transit-oriented development.

O'Toole: What is wrong with what you call "sprawl"? The Russians say that "Americans don't have real problems, so they make them up." Sprawl is one of those made-up problems. Pollution from auto driving is rapidly declining even though we drive more every year. Auto fatalities are also declining. Lower densities translate to lower housing and consumer costs, lower taxes, and less congestion. If people decide to move to higher densities, that is up to them. I only oppose subsidies and regulation designed to promote higher densities and discourage lower densities.

Litman: There is considerable literature on the costs of sprawl and benefits of smart growth (Litman, 2003b). Smart growth is supported by many mainstream organizations including the Institute of Transportation Engineers (ITE, 2003), the International City/County Management Association (ICCMA, 1998) and the American Governor's Association (Hirschhorn, 2001), because of cost savings and other benefits. As a person of Russian descent I recommend against making general statements about what Russians say: two Russians, three opinions. None of O'Toole's claims are completely true. Some U.S. cities are experiencing increasing air pollution problems as vehicle mileage growth offsets vehicle-mile emission reductions. Per capita traffic fatalities are much higher in sprawled communities. Lower density housing often increases housing and transportation costs. As mentioned above, O'Toole indicates his bias by showing no concern about large subsidies and regulations favoring automobile dependency and sprawl.

9. LACK OF REFERENCES A VALID CRITICISM

O'Toole: You accurately point out that I failed to provide adequate references to some of my statements. I still stand behind those statements. In one case, I said that most rail cities are spending over half their transportation capital funds on transit. You can find the references at http://ti.org/vaupdate24.html. I will send you the list of EISs that I used to review rail costs and ridership soon.

Litman: That is helpful. However, the evidence presented misrepresents the issue. Rail transit projects show up in regional capital budgets, so they may appear proportionately large, but regional capital budgets are only a small portion of total transport expenditures. Analysis should consider total local, regional and state capital and operating expenditures, plus expenditures by businesses on parking , and by consumers on vehicles and residential parking. Evaluation should reflect marginal analysis, not regional mode share. The major urban transport problems are traffic and parking congestion on major corridors, and inadequate mobility for non-drivers. Transit improvements can address these, and help achieve other objectives, including consumer cost savings, parking cost savings, reduced accidents and pollution emissions. As a result, transit investments that improve service quality and attract discretionary travelers are often the most cost effective transportation improvement, even if they provide a small portion of total regional travel.

10. LAND USE IMPACTS

O'Toole: You claim that "increased density and clustering tends to reduce per capita automobile ownership and use." There is little if any evidence of that. It would be more accurate to say that "increased density and clustering tends to be correlated with lower per capita automobile ownership and use," and that is accurate only at the neighborhood level. All of the papers you cite focus on neighborhoods. The problem is self selection: people who want to use transit tend to live in transit-friendly neighborhoods. But increasing the density of neighborhoods occupied by people who want to drive is not going to significantly reduce their driving.

Litman: Many studies indicate that transit-oriented development can reduce per capita vehicle ownership and use ("Land Use Impacts on Transportation," VTPI, 2004). For example, a survey of Portland TOD residents found that 22% commute by transit, far higher than the 5% regional average, and 69% use public transit more often than in their previous community (Podobnik, 2002). This study shows that having numerous TODs in a city can significantly reduce regional per capita vehicle ownership and mileage rates.

"Light Rail Boon or Boondoggle" *(Castelazo and Garrett, 2004; Garrett, 2004)*

An article by Molly D. Castelazo and Thomas A. Garrett and a related report by Thomas A. Garrett argue that light rail transit investments are inefficient compared with automobile investments. However, their arguments reflect a number of omissions, errors and misrepresentations (CMT, 2004; Litman, 2004d).

Castelazo and Garrett argue that travel decisions should be tested based on consumer willingness to pay. Most economists would agree that an efficient market requires that prices (what consumers pay for a good) should reflect marginal costs (what it costs to produce that good), unless a subsidy is specifically justified. Castelazo and Garrett claim that rail transit fails to meet this test, since rider fares only cover a portion of total costs. However, they ignore the underpricing of urban automobile travel, including the costs of roads, parking facilities, congestion impacts, vehicle insurance and environmental impacts (Murphy and Delucchi, 1998; FHWA, 1997; Litman, 2003a). This underpricing is particularly large under urban-peak conditions, while transit subsidies tend to be lowest under such conditions due to higher load factors.

In addition, public transit subsidies can be 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. Since transit dependent people tend to travel much less than motorists per year, much higher subsidies per passenger-mile may be justified for transit users than for motorists, in order for each to receive an equal share of transportation subsidies per year.
- *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 provides 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, and indicates that they are unfamiliar with the issues. As described earlier, there is both theoretical and empirical evidence that high quality rail transit can provide significant, long-term reductions in per capita traffic congestion (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.

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 many transportation problems is more efficient pricing of 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. In total such price reforms would significantly increase the cost of driving (or put more positively, would significantly reward consumers for reducing their annual mileage), particularly under urban-peak conditions, causing a major portion of urban-peak automobile travel to shift to transit (Litman, 2002). Since rail transit experiences significant economies of scale, more optimal pricing can be expected to significantly increase rail transit ridership and the cost effectiveness of rail transit service. In other words, pricing and transit investments are complements, not substitutes.

Conversely, 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.

Comparing Transit and Automobile Costs

Castelazo and Garrett argue that rail transit is *cost ineffective*, but they make a number of critical errors in their analysis (See "Common Errors Made When Comparing Transit and Automobile Transport," Litman, 2004a). 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 of accommodating additional motor vehicle traffic in the 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 rail is more costly than bus transit. Of course, under some circumstances rail has higher costs per passenger-mile, and under other circumstances rail has lower costs. They 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*, APTA, 2002). There are various 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 in the dense urban corridors where rail is actually implemented.

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 (Murphy and Delucchi, 1998; FHWA, 1997; Litman, 2004a). This indicates that automobile travel on these corridors costs $0.77 to $1.76 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, if rail transit really does have excessive costs per passenger-mile, the appropriate response may be provide *more* rather than *less* support for rail, through incentives such as road and parking pricing, fare subsidies or other strategies that increase ridership, and therefore reduce unit costs.

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 for 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.

The table below evaluates the impacts of subsidizing cars for low-income drivers who would use rail transit, and therefore travel regularly on congested urban corridors. Although this benefits a certain group (low-income urban commuters on a particular corridor), it exacerbates other problems including congestion, road and parking facility costs, traffic accidents, energy consumption and pollution emissions.

Table 3 **Impacts of Subsidizing Commuter Cars**

Transit Objectives	Effect of Subsidizing Cars
Basic mobility for low income drivers.	Helps
Basic mobility for non-drivers.	No effect or harmful.
Congestion reduction.	Harmful.
Road and parking facility cost savings.	Harmful.
Consumer cost savings.	Helps those who receive the subsidy.
Reduce traffic accidents.	Harmful.
Energy conservation	Harmful.
Emission reductions.	Harmful.
Economic development benefits	No effect or harmful.

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 they claim. Eliminating scheduled transit service would force riders who cannot drive to use demand-response or taxi services, which have far higher costs.

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.

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%. 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.

Fifth, there are substantial practical problems subsiding cars or carsharing instead of transit services. 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, rail transit 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 car, which is particularly beneficial to non-drivers.

Although it is desirable to provide affordable mobility to lower-income people ("Affordability," VTPI, 2004), it is important to avoid oversimplifying this issue or ignoring the important role transit service play in meeting this need.

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 complete transit system. 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 ignoring basic economic evaluation principles, which require that all impacts be considered.

Castelazo and Garrett's research shows that rail transit projects can significantly increase property values. They find that average home values increase $140 for every 10 feet closer they are to a MetroLink station, beginning at 1,460 feet. A home located 100 feet from the station has a price premium of $19,029 compared with the same house located 1,460 feet away.[7] This represents a 32% increase in property values. Their analysis did not investigate property value impacts on commercial properties, which probably also increase with proximity to stations. This increase in property values, increased tax revenue, and the implied additional value to consumers, offsets a significant portion of MetroLink costs.

"Urban Rail: Uses and Misuses" *(Cox, 2000)*

Wendell Cox is a frequent critic of rail transit. For example, in a policy statement titled *Urban Rail: Uses and Misuses* he makes the following arguments.

Virtually no traffic congestion reduction has occurred as a result of building new urban rail systems.
While city-wide congestion measured as roadway level of service or travel time index does not usually decline after light-rail systems are built, this is not surprising because light rail is developed where travel demand is growing, and light rail represents a small portion of total regional travel. Rail transit clearly does reduce congestion compared with what would have occurred otherwise, and when evaluated at the corridor level. As described earlier in this report, and in Litman (2004a and 2004b):

- Large cities with rail transit systems have about half the per capita traffic congestion costs as similar size cities that lack rail transit. The more rail transit service provided, the more rail ridership and the more congestion is reduced.
- Traffic congestion tends to decline on a road if there is fast and comfortable rail transit service on the same corridor, since some travelers will shift to transit when it is faster than driving, reducing the point of congestion equilibrium.
- Residents of urban neighborhoods served by new or expanding rail transit systems tend to reduce their vehicle ownership and increase their use of transit, reducing per capita automobile trips (see box).
- On major urban corridors, rail transit improvements are often more cost effective than roadway capacity expansion, when all costs are considered.
- Traffic congestion growth rates declined after light rail systems were built in several cities. Garrett (2004) found that traffic congestion growth rates declined somewhat in some U.S. cities after light rail service began. In Baltimore the congestion index increased an average of 2.8% annually before light rail, but only 1.5% annually after. In Sacramento the index grew 4.5% annually before light rail, but only 2.2% after. In St. Louis the index grew an average of 0.89% before light rail, and 0.86% after. In Dallas, the growth rate did not change.

Transit Improvements Help Reduce Vehicle Ownership and Use (www.translink.bc.ca)
In 2004 the city of Vancouver recorded a small decline in the number of automobiles registered in the city, and a reduction in downtown automobile trips, reversing a growth trend between 1994 and 2003. Small decreases were also recorded in some nearby suburbs, and others saw a reduction in the growth rate. Experts conclude that this results from increased transit services and a growing preference for urban lifestyle. "There are some fundamental changes going on," says David Baxter of the research firm Urban Futures. "It's increasingly possible to live in Vancouver without a motor vehicle."

Commuters are increasingly alternative modes. Transit ridership rose by 9.5% in the first half of this year compared to the same period last year, and was 24.6% higher than 2002. Bus trips increased by 11.1%, and rail trips increased by 5.4%. A customer survey found that that 42% of riders on the SkyTrain, 49% on the West Coast Express, 35% on the 99B bus route and 25% on the 98B route switched from commuting by car. "The numbers show that demand for public transit continues to grow in response to the significant expansion of services."

Virtually any public benefit that has been achieved through urban rail could have been achieved for considerably less by other strategies.
Rail transit provides unique benefits. Cities with large rail transit systems have substantially higher per capita transit ridership, lower per capita congestion delays, lower per capita traffic fatalities, lower consumer transportation costs, lower transit operating costs, higher transit service cost recovery, and other positive attributes, compared with otherwise similar cities (Litman, 2004a). This occurs because rail tends to attract far more discretionary riders than bus, does not require the ability to drive like a private automobile, avoids congestion delays if grade separated, and it can have a leverage effect on land use which greatly expands total benefits.

Where the automobile has become the dominant form of transport, and where urban areas have become decentralized and highly suburbanized, there are simply not a sufficient number of people going to the same place at the same time to justify urban rail. As a result, it is typically less expensive to provide a new car for each new rider than to build an urban rail system.
Many cities are redeveloping, with increased population and business activity. At the same time, many suburbs are becoming more urbanized. If a travel corridor has enough travel demand to create significant congestion, there is often enough demand to justify some form of grade-separated transit.

Claims that it is cheaper to provide a new car rather than build an urban rail system usually overlook some significant costs, including the costs of vehicles, roads and parking facilities at destinations (as discussed earlier and in Litman, 2004d). Increased car ownership exacerbates other transportation problems, including traffic congestion, road and parking facility costs, traffic accidents and pollution emissions, and does not address the mobility needs of non-drivers. Expanding urban road and parking capacity is costly, and provides only modest congestion reduction due to latent demand.

Cox (2004) also argues that it would be cheaper to subsidize carsharing (vehicle rental services designed to substitute for private vehicle ownership), which he assumes 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.

Cox (2003) argues that virtually all current trends favor automobile transportation over transit, that extreme densities are needed for rail transit to be effective, that an excessive portion of urban transportation funding is devoted to public transit, and that investments in highway capacity expansion are a more cost effective way to improve urban transportation. His analysis makes many of the errors discussed earlier in this paper.

1. Many current demographic and geographic trends actually favor increased use of alternative modes, including an aging population, increased urbanization (many cities are experiencing population growth, and many suburbs are developing into cities), physical constraints to expansion in many growing urban areas (for example, Los Vegas is limited by water supply and Seattle is limited by geography), and higher future oil prices.

2. The analysis and arguments are based on the assumption that vehicle traffic congestion is the only significant transportation problem facing cities, and therefore reducing roadway congestion is the only planning objective. Other transportation problems, such as mobility for non-drivers, parking problems, consumer and government affordability, traffic safety, urban environmental quality, and energy conservation and pollution emission reductions are unimportant and not incorporated in his performance evaluation.

3. He significantly underestimates the full costs of increasing urban traffic capacity enough to reduce congestion. Cox dismisses the effects of generated traffic, although it is accepted by nearly all serious traffic modelers (see Litman, 2001), including the fact that it reduces the congestion reduction benefits of increasing roadway capacity, and the additional impacts of the added vehicle traffic.

4. Estimates of the portion of total transportation expenditures devoted to transit (Table 2) are not clearly referenced, and even if accurate are greatly exaggerated, since they do not account for all local, state and federal expenditures, or indirect costs, such as expenditures on parking facilities.

5. Cox dismisses the potential role of public transit, on the grounds that transit only carries 1% of total projected traffic growth. But on congested urban corridors transit can carry a much larger portion of traffic, and make a much larger contribution toward congestion reduction. If a travel corridor has enough travel demand to create significant congestion, there is often enough demand to justify some form of grade-separated transit.

6. Cox assumes the only way to increase transit ridership and transit system performance is to greatly increase regional land use densities. But there are many other options which are justified on economic efficiency grounds, including road and parking pricing reforms, transit oriented development (which clusters development around transit stations, but does not necessarily increase regional densities), transit priority strategies, commute trip reduction programs, transit service improvements and targeted transit fare discounts.

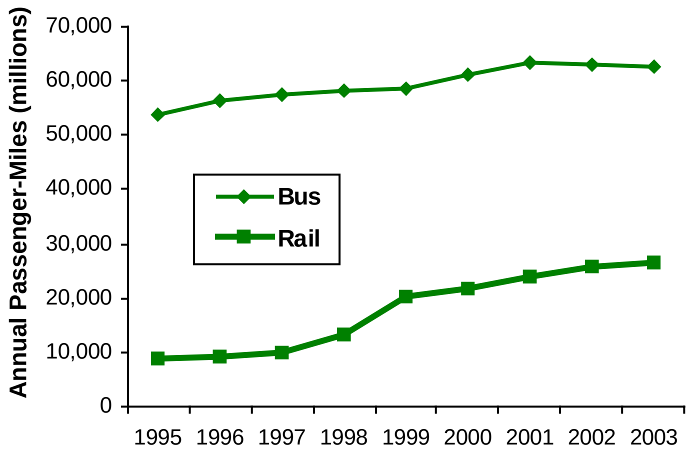
7. Cox's analysis includes various unexplained assumptions and data sources, such as the claim that urban traffic congestion could be significantly reduced with a $39 billion highway program, or that this provides a 6:1 benefit/cost ratio. Many of his arguments, such as the claims that highway widening causes no induced vehicle travel, or that smart growth and increased transportation system diversity are politically unacceptable, are based on nothing more than selective anecdotal evidence. In fact, there is plenty of evidence showing the opposite (Litman, 2001; Litman, 2003a).

Other Criticisms of Rail

Some additional criticisms raised about rail transit are evaluated below.

1. Americans love to drive, and so will not use transit.
An efficient rail system doesn't require that it replace every automobile trip. In most cases a 5-20% mode shift on major corridors is sufficient to justify the investment. Although few automobile owners want to give up vehicle use entirely, consumer surveys indicate that many North Americans would prefer to drive somewhat less and rely more on alternatives, such as high quality rail transit, on congested urban corridors.

Figure 4 **Portland Transit Ridership Trends** (APTA Data)



Portland rail transit ridership is growing faster than bus ridership.

Where quality transit is provided, ridership has grown. Per capita transit ridership increases as a rail transit system expands, due to network effects. Figure 1 shows that overall transit ridership has been growing in recent years, and Figure 4 shows that Portland's rail transit ridership is growing rapidly as the system expands in that city. Experience indicates that North Americans will increase transit ridership in response to incentives such as transit service improvements, fare discounts, parking cash out, and transit oriented development (VTPI, 2004). If rail ridership is considered too low, the best solution may be to increase support and expand the system, not to abandon the concept.

2. Even with significant growth, rail transit carries too few travelers to improve transportation system performance.
This criticism could also be made about most individual highway projects. Although rail transit carries just a small portion of total regional travel in most cities, it serves the most congested routes and destinations where even a small reduction in traffic volumes can provide significant benefits from reductions in congestion, road and parking costs, vehicle costs and traveler stress. On such corridors, rail transit is often more cost effective than accommodating additional trips by automobile, when all costs are considered.

3. Efficient transit requires far higher densities (often reported at 50,000 residents per square mile) than is found in North American cities except New York.
Regional population densities are not important in determining transit demand. Rather, rail requires a sufficient number of riders on a particular urban corridor. Rail can operate efficiently if employment is clustered in downtowns and regional commercial centers, and a portion of housing is located in transit oriented developments within a half-mile of transit stations. Light rail requires a minimum density of 9 residential units per acre, a standard that can be met with a combination of single-family housing (4-8 units per acre) and low-rise apartments (25-50 units per acre) (Pushkarev and Zupan, 1977). Even lower densities may be sufficient if some rail trips are by park-and-ride, or if transit is supported by incentives such as discounted passes and parking cash out, to increase per capita transit trip rates (VTPI, 2004).

4. Rail transit is too slow to be useful or attractive.
Although average rail transit speeds are low compared with regional average automobile trip speeds, this is a false comparison (Litman, 2004a). On the congested urban corridors served by rail, automobile travel speeds tend to be much lower, so rail trips tend to be more competitive. In addition, many consumers tend to consider time spent traveling by quality transit (passengers have a seat, vehicles are comfortable, safe and quiet) to have less cost than the same amount of time spent driving in congested conditions.

5. Rail is not a cost effective way to reduce traffic congestion, reduce air pollution, improve mobility for non-drivers, etc.
Rail transit is not necessarily the most cost effective way to address any single problem, but it provides numerous benefits, particularly if it attracts discretionary travelers who would otherwise drive. Table 4 lists transit benefits, and compares this with roadway capacity expansion. Road expansion provides just one benefit, congestion reduction, and if it stimulates additional driving and urban expansion, it increases many transportation problems, such as parking congestion, accidents and energy consumption. When all costs and benefits are considered, rail transit is often most cost effective overall.

Table 4 **Benefits of Transit Improvements and Roadway Expansion**

Transport Planning Objectives	Transit Improvements	Roadway Expansion
Reduce traffic congestion	X	X
Reduce parking congestion	X	
Reduce traffic accidents	X	
Reduce road and parking facility costs.	X	
Provide consumer savings.	X	
Provide mobility for non-drivers	X	
Provide mobility for low income travelers.	X	
Reduce energy consumption	X	
Reduce pollution emissions	X	
Support urban redevelopment and reduce sprawl.	X	

This table compares the benefits of transit improvements and roadway expansion. Although rail projects may not be the most cost effective way to solve any individual problem, when all impacts are considered, rail transit is often most cost effective overall.

Careless Omissions Or Intentional Bias?

Good research provides comprehensive information so readers can make a fair judgment about an issue. Good research follows principles and practices to insure that information is accurate and balanced, as listed below. Critics generally fail to follow these practices.

Good Research Practices (Litman, 2004c)

- Attempts to fairly present all perspectives of an issue.
- Provides context information by summarizing issues and by referencing relevant documents.
- Carefully defines research questions, which link specific research to broader issues.
- Provides accurate data and appropriate analysis in a format that can be accessed and replicated by others.
- Discusses critical assumptions made in the analysis, such as why a particular data set or analysis method is used.
- Presents results in ways that highlight critical findings.
- Discusses conclusions and their implications. Discusses alternative explanations and interpretations, including those with which the researcher disagrees.
- Describes analysis limitations and cautions. Does not exaggerate implications.
- Is respectful to people with other perspectives.
- Provides adequate references.
- Indicates funding sources, particularly any that may benefit from research results.

These critics fail to discuss key decisions concerning the selection of data sources and analysis methods. For example, O'Toole does not discuss the various congestion indicators available for comparing cities, and why he selected the Travel Time Index. This index undervalues the congestion reduction impacts of grade-separated transit, because it only measures the intensity of delay experienced by road vehicle occupants, and overlooks the congestion reduction benefits that result when people shift to alternative modes, and from more compact land use that reduces travel distances. Similarly, O'Toole does not explain why he compares transit energy consumption rates with those of passenger cars, rather than the higher weighted fleet average rate. Similarly, Castelazo and Garrett do not discuss why they use national cost values (54.4¢ per passenger-mile) rather than local values (27¢ per passenger-mile) when assessing rail costs transit. Cox makes general statements without evidence, many of which are contradicted by current research.

In virtually every situation, these critics choose the data and analysis option that presents rail transit most negatively. It is possible that they have valid reasons for making these choices, but they do not describe them as required for good research practices. This suggests that the various omissions and distortions in these reports are intentional, designed to present rail transit in a negative light, rather than to provide fair and comprehensive information on benefits and costs.

Points of Agreement

Transit critics raise some important issues. I agree that the relatively low portion of total trips made by public transit, and the declining transit mode share, are concerns. However, I believe that this reflects the need to correct existing market distortions that favor automobile travel over transit. Simple market reforms that are justified on both efficiency and equity grounds, such as parking cash out, distance-based vehicle registration and insurance pricing, and least-cost planning, can substantially increase transit ridership by creating a more level playing field ("Transit Encouragement," VTPI, 2003). Various cost effective strategies for improving transit service and increasing ridership are described in the next section.

It is also reasonable to argue that rail transit investments should not be made at the expense of bus service. In many situations, incremental bus service improvements may provide faster, more equitable and greater total benefits than rail transit improvements. However, bus systems do not seem to have the positive effect that rail has on land use accessibility, has less ability to attract discretionary riders, and has some disadvantages compared with rail on high demand corridors.

The relatively high traffic accident rate of rail transit is also a concern, and efforts should be made to reduce this through education and traffic management. Recent experience in Salt Lake City and Houston indicate that crash rates are high when light-rail systems are first introduced in a city, but decline as drivers become familiar with new traffic operations. However, these high crash rates per passenger-mile are offset many times over by reductions in per-capita crash fatalities, and are probably further offset by additional health benefits from reductions in urban air pollution exposure, and increased walking by commuters who shift from driving to transit.

My criticism of omissions and errors by critics must be tempered by the fact that the data needed for some analyses are unavailable. In particular, it is difficult to obtain accurate data on the marginal cost of expanding roadway, bus and rail systems, and so it is often necessary to use average cost data. But a rough estimate of marginal costs is more accurate than precise average cost data, and when average values are used it is important to identify the direction of error: it is clear that marginal roadway and parking facility capacity expansion costs tend to be higher in dense urban centers, and that transit demand is particularly high in such corridors, which can result in low unit costs.

I also am concerned about housing affordability and the impacts of planning decisions on low-income households. However, research by myself and others indicates that more accessible community design, more diverse transportation systems, and more flexible residential development standards are the best way to improve overall affordability and increase economic opportunity, because they can reduce both housing and transport costs, and provide other benefits to lower-income people, such as improved accessibility for non-drivers ("Location Efficiency Development," VTPI, 2003).

Conclusions

There has been considerable debate over the merits of rail transit. Critics argue that it is outdated, ineffective at solving transportation problems, and wasteful, but their analysis is based on various omissions, errors and misrepresentations. It ignores or understates many benefits of transit, and underestimates the full costs of accommodating additional automobile traffic on congested urban corridors.

Many of the factors favored automobile travel over transit during the last century are leveling off or reversing. Many demographic and economic trends now support an increased role for quality transit in the future.

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 are wrong when they claim that rail transit does not reduce traffic congestion. There is plenty of evidence that per capita congestion costs are lower on corridors with high quality rail transit, because a portion of motorists shift to transit whenever it is faster than driving. Critics are either unfamiliar with current research, measuring congestion impacts in ways that undervalue transit impacts, or intentionally misrepresent the issues.

Critics may be correct that rail transit is not the most cost effective way of reducing individual problems such as traffic congestion or air pollution, but it provides multiple benefits, while other solutions tend to conflict with other planning objectives. Critics are simply unable to account for multiple benefits and so undervalue transit.

Critics claim that rail transit is excessively subsidized, but rail transit subsidies are often lower than subsidies for bus transport, and far lower than the total external costs of automobile transport under urban travel conditions. Transit subsidies are justified for the sake of equity, to offset various market distortion, due to economies of scale, or to help achieve a strategic planning objective, factors that critics generally ignore.

Although it would not be cost effective to provide 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.

References

APTA, *Off Track: Response of the American Public Transit Association and the Transit Industry to the UMTA Report "Urban Rail Transit Projects: Forecast Versus Actual Ridership and Costs,"* American Public Transit Association (www.apta.com), 1990.

APTA, *Transit Statistics: Statistics By Transit Agency*, American Public Transit Association (www.apta.com/research/stats/agency/index.cfm), 2002.

Danielle **Arigoni**, *Affordable Housing and Smart Growth: Making the Connections*, Smart Growth Network (www.smartgrowth.org) and National Neighborhood Coalition (www.neighborhoodcoalition.org), 2001.

Ted **Balaker**, *Past Performance Vs. Future Hopes: Will Urban Rail Improve Mobility In North Carolina?*, Policy Study 321, Reason Public Policy Foundation (www.rppi.org/ps321.pdf), June 2004.

Antonio M. **Bento**, Maureen L. Cropper, Ahmed Mushfiq Mobarak and Katja Vinha, *The Impact of Urban Spatial Structure on Travel Demand in the United States*, World Bank Group Working Paper 2007, World Bank (http://econ.worldbank.org/files/24989_wps3007.pdf), 2003.

Cambridge Systematics, *Economic Impact Analysis of Transit Investments: Guidebook for Practioners*, Report 35, Transit Cooperative Research Program, TRB (www.trb.org), 1998.

Edward **Carman**, Berry Bluestone and Eleanor White, *Building on our Heritage: A Housing Strategy for Smart Growth and Economic Development*, Center for Urban and Regional Policy, Northwestern University (www.curp.neu.edu), October 2003.

Molly D. **Castelazo** and Thomas A. Garrett, "Light Rail: Boon or Boondoggle," *The Regional Economist* (www.stlouisfed.org/publications/re/2004/c/pages/light_rail.html), July 2004.

CFTE, *CFTE O'Toole Response*, Center for Transportation Excellence (www.cfte.org), 2003.

CMT, *Light Rail - The Facts; Critics Refute Federal Reserve Arguments*, Citizens for Modern Transit (www.cmt-stl.org/issues/fedreserve.html), 2004.

Wendell **Cox,** *Urban Rail: Uses and Misuses*, The Public Purpose (www.publicpurpose.com/pp-railpol.htm), 2000.

Wendell **Cox**, *Performance Indicators in Urban Transport Planning*, Presented to the 8th International Conference on Competition and Ownership in Land Passenger Transport ("Thredbo 8") Rio de Janeiro, September 2003; available at www.publicpurpose.com/t8-gbc.pdf.

Wendell **Cox,** *Why Not Just Buy Them Cars*, The Hartland Foundation (www.heartland.org/Article.cfm?artId=15340), 2004.

ECONorthwest and PBQD, *Estimating the Benefits and Costs of Public Transit Projects*, TCRP Report 78, (http://gulliver.trb.org/publications/tcrp/tcrp78/index.htm), TRB (www.trb.org), 2002.

FHWA, *1997 Federal Highway Cost Allocation Study* (including appendices) USDOT (www.fhwa.dot.gov/policy/hcas/summary/index.htm), 1997 and 2000.

FTA, *Transit Performance Monitoring System (TPMS) Results*, American Public Transit Association (www.apta.com) and the Federal Transit Administration (www.fta.dot.gov/transit_data_info/reports_publications/reports/16031_ENG_HTML.htm), 2002.

Thomas A. **Garrett**, *Light Rail Transit in America: Policy Issues and Prospects for Economic Development*, Federal Reserve Bank of St. Louis (www.stlouisfed.org), 2004.

GAO, *Federal-Aid Highways: Cost and Oversight of Major Highway and Bridge Projects--Issues and Options*, General Accounting Office, GAO-03-764T (www.gao.gov), May, 2003.

GAO, *Highways and Transit: Private Sector Sponsorship Of And Investment In Major Projects Has Been Limited*, General Accounting Office, GAO-04-419 (www.gao.gov), March 2004.

Joel S. **Hirschhorn**, *New Community Design to the Rescue*, National Governor's Association (www.nga.org), 2001.

HLB, *Economic Study to Establish A Cost-Benefit Framework For The Evaluation of Various Types of Transit Investments*, Transport Canada (www.tc.gc.ca), 2002.

ICCMA, *Why Smart Growth: A Primer*, International City/County Management Association, Smart Growth Network and USEPA (www.epa.gov/smartgrowth), 1998.

ITE, *Smart Growth Transportation Guidelines*, Smart Growth Task Force, Institute of Transportation Engineers (www.ite.org), 2003.

Wenya **Jia** and Martin Wachs, *Parking Requirements and Housing Affordability; A Case Study of San Francisco*, Research Paper 380, UTCD (http://socrates.berkeley.edu/~uctc), 1998.

David **Lewis** and Fred Laurence Williams, *Policy and Planning as Public Choice: Mass Transit in the United States*, Ashgate (Aldershot; www.ashgate.com), 1999.

Todd **Litman**, "Generated Traffic; Implications for Transport Planning," *ITE Journal*, Vol. 71, No. 4, Institute of Transportation Engineers (www.ite.org), April, 2001, pp. 38-47; also available at Victoria Transport Policy Institute (www.vtpi.org).

Todd **Litman**, *Socially Optimal Transport Prices and Markets*, Victoria Transport Policy Institute (www.vtpi.org), 2002.

Todd **Litman**, *Transportation Cost and Benefit Analysis Guidebook*, Victoria Transport Policy Institute (www.vtpi.org), 2003a.

Todd **Litman**, *Evaluating Criticism of Smart Growth*, Victoria Transport Policy Institute (www.vtpi.org), 2003b.

Todd **Litman**, *Rail Transit In America: Comprehensive Evaluation of Benefits*, Victoria Transport Policy Institute (www.vtpi.org), 2004a.

Todd **Litman**, *Evaluating Public Transit Benefits and Costs*, VTPI (www.vtpi.org), 2004b.

Todd **Litman**, *Evaluating Research Quality*, VTPI (www.vtpi.org), 2004c.

Todd **Litman**, *Evaluating Public Transit Benefits in St. Louis: Critique of "Light Rail Boon or Boondoggle*," Citizens for Modern Transit (www.cmt-stl.org), 2004d; available at www.cmt-stl.org/images/litman.pdf.

Barbara **McCann**, *Driven to Spend; The Impact of Sprawl on Household Transportation Expenses*, STPP (www.transact.org), 2000.

Robert H. **Muller**, *Tollroad Feasibility Studies; An Historical Perspective*, Transportation Research Board Annual Meeting, (www.nas.edu/trb), January 2001.

James **Murphy** and Mark Delucchi, "A Review of the Literature on the Social Cost of Motor Vehicle Use in the United States," *Journal of Transportation And Statistics*, Vol. 1, No. 1, Bureau of Transportation Statistics (www.bts.gov), January 1998, pp. 15-42.

Arthur C. **Nelson**, Rolf Pendall, Casy Dawkins and Gerrit Knaap, *The Link Between Growth Management and Housing Affordability: The Academic Evidence*, Brookings Institute (www.brook.edu/dybdocroot/es/urban/publications/growthmang.pdf), 2002.

Randal **O'Toole**, *Great Rail Disasters; The Impact Of Rail Transit On Urban Livability*, Reason Public Policy Institute (www.rppi.org), 2004. A nearly identical report was subsequently released by the Texas Public Policy Foundation (www.texaspolicy.com) in June 2004.

Don **Pickrell**, "A Desire Named Streetcar: Fantasy and Fact in Rail Transit Planning," *Journal of the American Planning Association*, Vol. 58, No. 2, Spring 1992, pp. 158-76.

Bruce **Podobnik**, *The Social and Environmental Achievements of New Urbanism: Evidence from Orenco Station*, Department of Sociology Lewis and Clark College (www.lclark.edu/~podobnik/orenco02.pdf), 2002.

Richard H. **Pratt**, *Traveler Response to Transportation System Changes, Interim Handbook*, TCRP Web Document 12 (www.trb.org), DOT-FH-11-9579, 1999.

Boris S. **Pushkarev** and Jeffrey M. Zupan, *Public Transportation & Land Use Policy*, A Regional Planning Association Book, Indiana University Press (www.indiana.edu/~iupress), 1977.

Donald C. **Shoup**, "In Lieu of Required Parking," *Journal of Planning Education and Research*, Vol. 18, 1999, pp. 307-320, available at (www.sppsr.ucla.edu/dup/people/faculty/Shoup%20Pub%202.pdf).

STPP, *Easing the Burden: A Companion Analysis of the Texas Transportation Institute's Congestion Study*, Surface Transportation Policy Project (www.transact.org), May 2001.

VTPI, *Online TDM Encyclopedia*, Victoria Transport Policy Institute (www.vtpi.org), 2004.

Paul M. **Weyrich** and William S. Lind, *Twelve Anti-Transit Myths: A Conservative Critique*, Free Congress Research and Education Foundation and the APTA (www.apta.com), 2001.

Clifford **Winston** and Ashley Langer, *The Effect of Government Highway Spending on Road Users' Congestion Costs*, DRAFT, Brookings Institute (www.brookings.edu), 2004.

Endnotes

[1] Subsequent rail critics such as Balaker (2004) rely heavily on O'Toole, citing him and his sources, and also fail to use best current practices in evaluating transit benefits or provide information that does not support his conclusions, such as the results of this study.

[2] For information on transit evaluation best practices see Cambridge Systematics, 1998; FTA, 1998: Lewis and Williams, 1999; Phillips, Karachepone and Landis, 2001; HLB, 2002; Kittleson & Associates, 2003; MKI, 2003 and Litman, 2004b.

[3] In mid-March, 2004 Randal O'Toole agreed to my request to provide more specific information on his analysis of transit project cost overruns and ridership shortfalls for review, but as of 12 April he had provided nothing. Without this information it is not possible to verify his claims.

[4] Flyvbjerg, Holm and Buhl (2002) conclude that transportation project cost projection accuracy did not measurably improve between 1990 and 1998, but Figure 3 of their report actually suggests that between 1985 and 1998 cost accuracy improved significantly. More detailed analysis is needed to determine whether rail transit cost and ridership projections have improved over time.

[5] For more discussion of these issues see Todd Litman, *Evaluating Research Quality: Guidelines for Scholarship*, Victoria Transport Policy Institute (www.vtpi.org), 2004.

[6] Many suburban communities are developing into towns and cities. A good example is Silver Springs, Maryland, which until the 1990s was a typical, automobile-oriented suburb, but has recently become a multi-modal city, with medium- and high-density development clustered around a rail transit station. Although such areas are classified as suburban, they enjoy significant benefits from rail transit service as a catalyst for more efficient land use development patterns.

[7] Their analysis also indicated that beyond 1,460 feet, property values increased with distance from MetroLink stations, but this probably location-related reflects other factors not included in their model, such as traffic volumes on nearby streets, rather than proximity to station.