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Public Transportation

The common joke in transportation circles is that people are really interested in getting their neighbors on public transit so they can drive their own cars on the open road.

Riding the Rails

A Look at Light Rail Transit

by Adam M. Zaretsky

No one disputes the usefulness of public transportation, particularly in urban areas where dense populations cause tremendous congestion commuting to central business districts. To relieve this congestion, governments have often advocated the use of public transportation, arguing that it reduces pollution and the demand for energy at the same time. Thus, the development, construction and updating of mass transit systems—particularly light rail—have become major undertakings for many cities that see these systems as a cure-all for these traffic-related problems (see glossary for a definition of light rail and other transit terms).

What Makes Public Transportation More Efficient?

Compared with single-occupant automobiles, public transportation, especially rail systems, is a much more efficient way to move people around a metropolitan area. According to the American Public Transit Association (APTA), in measures of fuel efficiency, one full bus equals six autos, and one full rail car equals 15 cars. APTA concludes that 200 gallons of gasoline could be saved each year by every commuter who switches from driving alone to public transit; 85 million gallons could be saved from a 10 percent increase in transit ridership in the five largest U.S. cities; and 135 million gallons could be saved from a 10 percent nationwide increase in ridership.[1]

In terms of air pollution, APTA cites estimates that one person using mass transit instead of driving to work alone for one year reduces hydrocarbon emissions by 9.1 pounds, carbon monoxide emissions by 62.5 pounds and nitrogen oxide emissions by 4.9 pounds. Per passenger mile traveled, electric rail produces 99 percent less hydrocarbon and carbon monoxide emissions and 60 percent less nitrogen oxide emissions than a single-person auto.

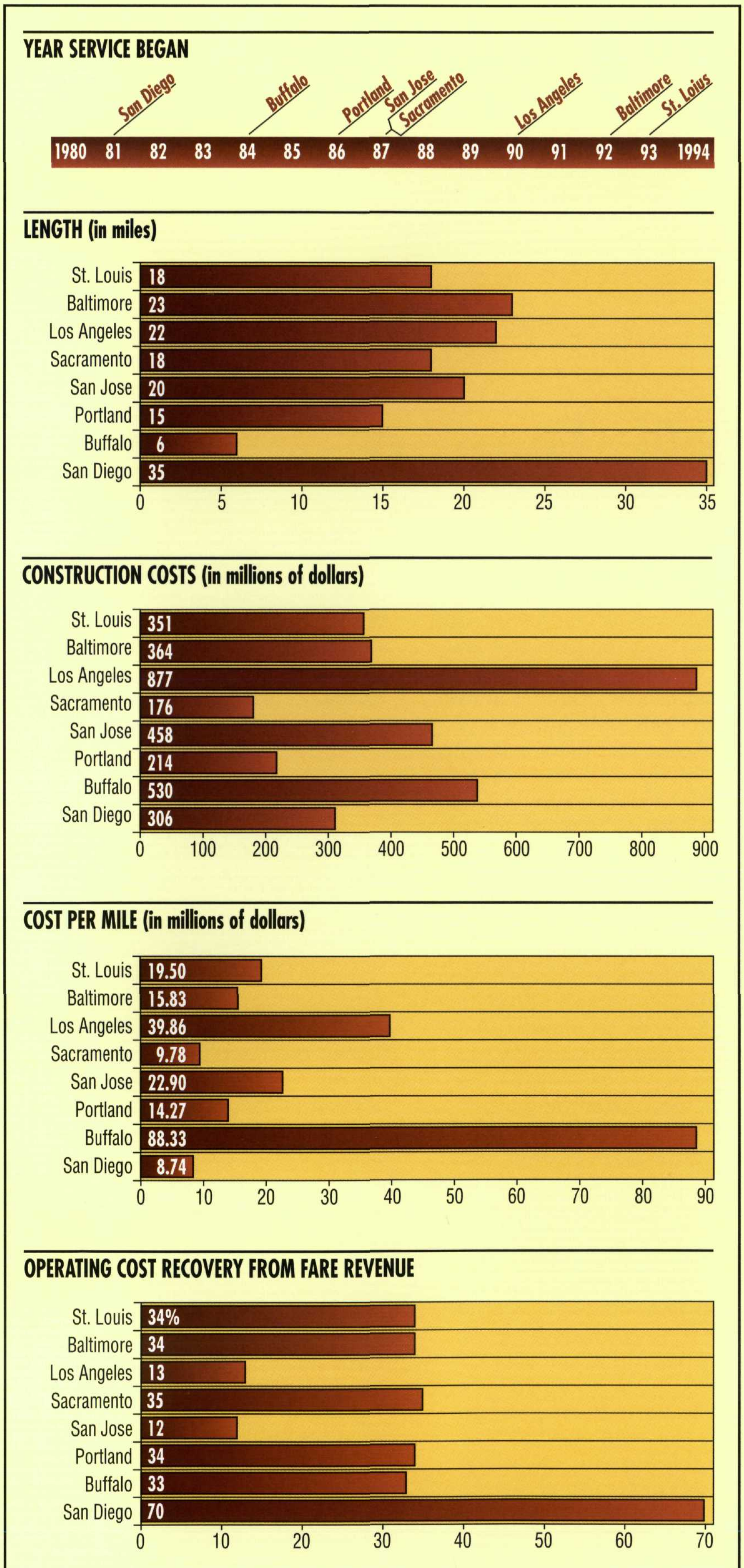
As for reducing congestion, one full 40-foot bus (about 70 passengers including standees) is the equivalent of 58 cars with an average of 1.2 passengers per car. This one bus is the equivalent of a line of autos that stretches six city blocks for traffic moving at 25 miles per hour.[2] Comparing autos and heavy rail, where one full heavy rail car can accommodate about 180 people including standees, a train of six rail cars, holding about 1,080 passengers, is the equivalent of 900 automobiles. Thus, one full six-car heavy rail train is the same as a line of moving cars that stretches 95 city blocks for traffic operating at 25 miles per hour. As these statistics clearly show, public transportation *is* energy-efficient and capable of reducing congestion.

Going From Here... To Where?

Designing an effective public transportation system is more difficult than it used to be, as urban and suburban development has altered commuting patterns. Today, most commuting patterns are not from the suburbs or urban residential areas to a central business district, but are instead between points in the suburbs, as businesses have followed their workforces from downtowns to the suburbs. Although this change does not affect bus service much, as routes can be altered to match commuting patterns, rail service can be rendered obsolete because fixed routes cannot be altered quickly or cheaply. Yet, because rail transit is the most efficient mode of public transportation available, many metropolitan areas continue to construct new or update existing rail systems. In some instances, cities see development of a rail transit system as part of a larger development program aimed at luring industry.

A Comparison of Recent Light Rail Systems

Although it seems construction costs should increase with length, the chart shows this is not true. In fact, construction cost per mile of track varies dramatically by city. In addition, recovery rates from fare revenue for most cities are only one-third of operating cost.



SOURCE: Tipton (1994).

Without being able to showcase a modern and efficient rail system, cities often consider themselves behind the development curve. To prevent this, many cities, with aid from the federal government, have chosen to construct light rail systems.

Accelerating Out of the Station

Between 1984 and 1992, light rail, which is essentially an updated streetcar system, was the fastest-growing segment of railway systems, which also include heavy rail and commuter rail. One indicator of this nationwide growth is the number of transit vehicles in active service. From the 733 light rail vehicles operating in 1984, the number grew to 1,058 by 1992, a 44 percent increase.[3] Over the same period, heavy rail vehicles increased only 13 percent, from 9,083 to 10,245. Commuter rail systems, meanwhile, added 338 vehicles, an 8 percent increase.

Vehicle miles operated also demonstrates light rail's growth: Light rail went from 16.8 million vehicle miles in 1984 to 28.7 million vehicle miles in 1992, a 71 percent increase.[4] In contrast, heavy rail, which has many more miles of laid track, increased only 21 percent, from 435.8 million vehicle miles operated to 525.4 million vehicle miles operated. Commuter rail increased 30 percent from 167.9 million to 218.7 million vehicle miles operated. The trend of passenger miles during this period is similar: Light rail increased 69 percent, from 416 million to 704 million passenger miles; heavy rail increased 6 percent, from 10,111 million to 10,737 million passenger miles; and commuter rail increased 18 percent, from 6,207 million to 7,342 million passenger miles.[5]

Some of the Stops Along the Way

During the 1980s, seven light rail systems were built or significantly reconstructed, spurring the strong growth discussed earlier: San Diego (1981), Buffalo (1984), Portland (1986), Sacramento (1987), San Jose (1987), Los Angeles (1990) and Pittsburgh (1988). Two systems started up in the 1990s: Baltimore (1992) and St. Louis (1993). Many other cities are in various stages of development or construction (see map).[6]

Construction Costs

The costs of construction vary by city, and as the charts show, the cost per mile of track ranges from as little as $8.74 million in San Diego to as much as $88.33 million in Buffalo. Of course, costs depend on a variety of factors, not all of which are controllable by the development agency—land acquisition, for example. In some instances, an agency must purchase the land (or have the local government take the land through eminent domain), while in other cases, rights-of-way already exist or land is donated.

The number and types of stations and the grade over which the system must travel also greatly affect costs. According to a 1991 report for the Urban Mass Transit Administration at the U.S. Department of Transportation, station construction costs can range from as little as $801,000 for a street-level station to as much as $16 million for a subway station. The report also shows that the average cost of constructing one mile of at-grade guideway is about $3.5 million, while constructing the same mile as a subway would cost $39.3 million.

To put all this information in perspective, about 99 percent of San Jose's route miles are at-grade, while only 66 percent of Pittsburgh's are; Pittsburgh has 13 percent of its route miles as subway. In addition, San Jose's system has 22 stations, while Pittsburgh's has 13 stations. Thus, just because one city's construction cost per mile of track laid is lower than another's does not make the lower-cost city's system any better or worse.

Operating Revenue

One problem light rail systems face is that passenger revenue is never sufficient to cover operating costs, thereby requiring other revenue sources. Of the eight cities listed in the table, San Diego recovers the greatest portion of operating costs from passenger revenue—70 percent—while San Jose recovers the smallest portion—12 percent. The average recovery rate for the eight cities is 33 percent. Thus, approximately two-thirds of a light rail's operating expense must be either raised through local taxes or subsidized by the government.

According to APTA, nationwide transit revenue received as assistance from a government agency between 1984 and 1992 increased from 55 percent to 58 percent of total revenues, and this while passenger revenue was increasing; it grew by 39 percent to about $6.2 billion.[7] At the same time, total government assistance, which includes subsidies, taxes levied directly by the transit system, bridge and tunnel tolls and nontransit parking lot revenue, increased 48 percent to almost $9.5 billion. Federal government assistance, however, declined 3 percent over this period, shifting a growing portion of the burden to local and state governments. Although this may translate into declining dollar amounts for transit agencies, it definitely results in a declining purchasing power of these dollars. For example, the Bi-State Development Agency, operator of mass transit in the St. Louis metropolitan area, reports in its fiscal year 1995 budget that federal assistance to the agency has remained relatively stable since 1988, at about $10.1 million per year. The purchasing power of these dollars, however, has not remained stable. In 1988 dollars, the agency's federal assistance has fallen from $10.4 million in 1988 to $8 million in 1994.

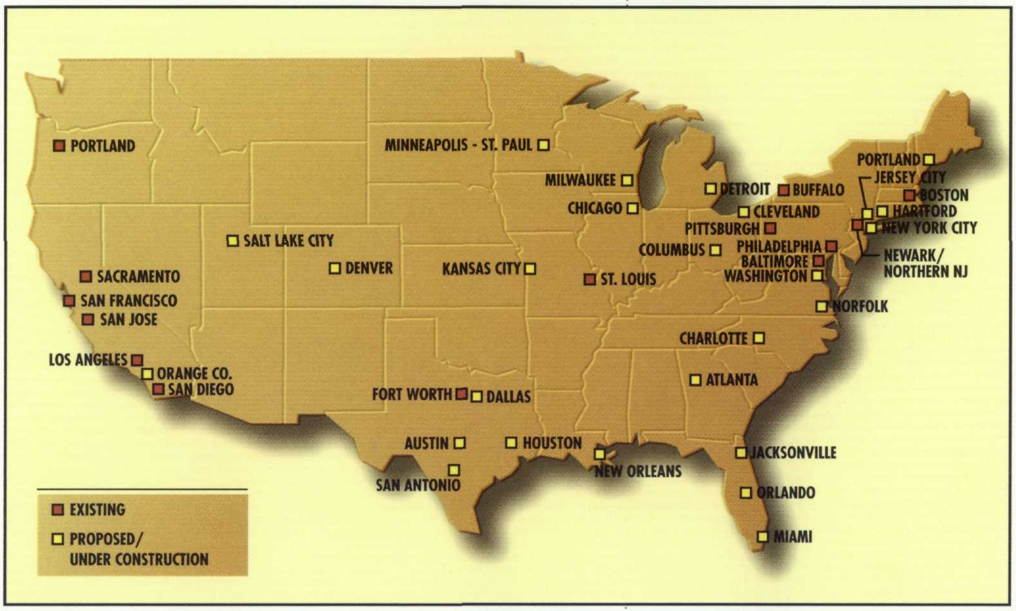
Government assistance may relieve the symptom but does not cure the disease: Nationwide passenger revenue received between 1984 and 1992 was not sufficient to cover vehicle operating expenses. In fact, passenger revenue in 1992 accounted for only 37.5 percent of total revenue and covered only 82 percent of vehicle operating expense.[8] Thus, one might question the feasibility of these rail systems if they cannot generate enough revenue to cover their operating costs.

Should They Operate If They Must Be Subsidized?

As economic theory tells us, a firm should generally not continue to operate if it cannot generate enough revenue to cover its operating costs.

Light Rail in America

Light rail is booming. Besides the light rail proposals shown below, most of the cities with existing systems also have plans to expand.



SOURCE: Phraner (1992) and U.S. Dept. of Transportation, Federal Transit Administration

Glossary of Transit Terms

Adult Base Fare
Basic fare paid by one person for one ride; excludes transfer, zone and express service charges, peak period surcharges and reduced fares.

Commuter Rail
Railroad local and regional passenger train operations between a central city, its suburbs, and/or another central city. May be locomotive-hauled or self-propelled and is generally characterized by multi-trip tickets, specific station-to-station fares, railroad employment practices, and only one or two stations in the central business district. Also known as "suburban rail."

Fixed Route
Service provided on a repetitive, scheduled basis along a specific route with vehicles picking up and discharging passengers at specific locations.

Heavy Rail
An electric railway with the capacity for a heavy volume of traffic and characterized by exclusive rights-of-way, multi-car trains, high speed and rapid acceleration, sophisticated signaling and high platform loading. Also known as "subway," "elevated (railway)" or "metropolitan railway (metro)."

Light Rail
An electric railway with a light volume traffic capacity. May use exclusive or shared rights-of-way, high or low platform loading, and multi-car trains or single cars. Also known as "streetcar," "trolley car" or "tramway."

Operating Assistance
Financial assistance for transit operations (not capital expenditures). Such aid may originate with federal, local or state governments.

Passenger Miles
Number of miles traveled by passengers determined by multiplying the number of unlinked passenger trips by the average length of their trips.

Passenger Revenue
Money, including fares and transfer, zone and park-and-ride parking charges, paid by transit passengers; also known as "farebox revenue."

Rapid Transit
Rail or motorbus transit service operating over a completely grade-separated exclusive right-of-way.

Revenue Passenger Trips
The number of fare-paying transit passengers with each person counted once per trip; excludes transfer and non-revenue trips.

Ridership
See unlinked passenger trips.

Total Operating Expense
The sum of vehicle operations, vehicle maintenance, nonvehicle maintenance, general administration and purchased transportation.

Unlinked Passenger Trips
Number of vehicle boardings, including charter and special trips. Each passenger is counted each time that person boards a vehicle.

Vehicle Maintenance Expense
Expense of labor, materials, services and equipment used to repair and to service transit vehicles and service vehicles.

Vehicle Miles Operated
Sum of miles traveled by passenger vehicles, including mileage when no passengers are carried. Each vehicle is counted separately: an eight-vehicle train operating for one mile equals eight vehicle miles.

Vehicle Operations Expense
Expense for labor, materials, fees and rents required for operating transit vehicles and passenger stations including fuels for vehicle propulsion except electric propulsion power.

In some sense, then, government is subsidizing an operation that should shut down. Of course, one response to this argument is that the rail system's direct operating costs are not adjusted for the indirect savings from lower energy consumption and the lessening of pollution and congestion. In addition, public transit contributes a positive byproduct by providing affordable transportation for those who cannot afford other means of transport, like owning a car or taking a taxi. Although these adjustments to operating expenses are not directly measurable, they can play an important role in determining the viability of a system.

Another potential solution to the passenger revenue problem is to raise the fare. Unfortunately, this does not usually work. Suppose, for example, that because the system is not earning enough revenue, its administration decides to increase the adult basic fare. In the beginning, ridership will decline, but not by too much because workers cannot quickly make new arrangements to get to work. Thus, rider demand is said to be inelastic, with the result being that, even though ridership falls somewhat, revenue increases. Over time, however, as workers do make other arrangements, ridership typically falls even more. In fact, in the long run, rider demand is said to be very elastic, and the result is that the decline in ridership overwhelms the fare increase, resulting in a revenue decline.[8] This decline then leads to larger government subsidies once again.

Ridership Problems

Total passenger revenue, of course, depends on the level of ridership, and as the remark at the beginning of the article indicates, many people believe that public transit is a great idea for someone else. Even in the nation's most congested urban areas, usage levels do not reach much beyond 50 percent of workers.[9] New York City, at about 53 percent, had the highest percentage of workers using public transportation in 1990, according to the Census Bureau. Usage percentages fall precipitously, however, as one looks down the list: Albany, NY, with the lowest percentage among the 26, saw only 15 percent of workers riding public transit. Of the 26 cities with the highest percentage, 16 are in the Northeast or on the Eastern Seaboard, which could indicate that there are regional differences in attitude toward public transit, that transit systems are more prevalent in these regions or that these areas are older and more congested.

One of the causes of these low percentages is that people tend to drive to work alone. According to national data from the Federal Highway Administration, more than 73 percent of all commuters in 1990 traveled in single-occupant automobiles.[10] Only 5 percent listed public transit as their primary means of commuting. Perhaps this is changing, however: An upward trend for ridership on the nation's light rail systems has occurred since 1986. Unlinked passenger trips on light rail have grown from 130 million in 1986 to 189 million in 1992, a 45 percent increase. Meanwhile, ridership on commuter rail increased only 3 percent, and ridership on heavy rail actually declined 5 percent.

Cities continue to build bigger and more sophisticated rail systems, in part, as a selling point to attract business.

Not unexpectedly, ridership patterns differ from city to city. In most cases, actual ridership has fallen far short of the projected figures. This is important because, in many instances, local development agencies use ridership projections to convince the Urban Mass Transit Administration of the department of Transportation that their rail projects are worthy of government assistance. For example, Pittsburgh originally projected almost 90,000 passengers each weekday; its preliminary counts showed about 20,000. Other cities, like Buffalo, Portland and Sacramento, exhibit similar trends, although not as dramatic.

In contrast, St. Louis' MetroLink has performed better than preliminary projections said it would: Weekday ridership averaged about 26,000 passengers during the first year—about 53 percent greater than the projected 17,000 passengers. This led the Bi-State Development Agency to revise its projections upward, especially because MetroLink's airport station had yet to open. According to the Agency's fiscal year 1995 budget, the preliminary engineering estimate for ridership in 1995 was 5.3 million total passengers. The new projection for 1995 is now for 8.5 million riders—a 23 percent increase over 1994's 6.9 million expected riders. MetroLink still recovers only about 34 percent of its operating costs from passenger revenue, however. Thus, even light rail success stories are subject to the reality that overall usage levels are low.

Since We've Built It, Can We Make Them Come?

Getting commuters to use public transit as their primary means of transportation clearly presents a significant problem. Recent legislation aimed at curbing pollution levels in most major metropolitan areas could change this. Removing the tax-deductibility of employer-paid parking subsidies, thereby making workers bear the full cost of parking in downtown areas, and requiring the use of higher-priced alternative fuels instead of regular gasoline in certain cities to control smog levels both provide incentives that make public transportation more desirable. Both policies attempt to increase the money cost of commuting for single-occupant vehicles enough to encourage workers to accept public transit as a viable alternative.

Last Stop: City Hall

Despite the many problems that still exist in moving people from their cars to the trains, cities continue to build bigger and more sophisticated rail systems, partly because the federal government is willing to dole out the money to support these projects and partly because local leaders see a modern, efficient rail system as a selling point to attract business. How effective a rail system becomes, though, depends heavily on the commuting patterns of the area and the ability of industry to locate along the rail line in the future. One of the major reasons Washington, D.C.'s Metro is considered relatively successful is because businesses were able to locate themselves along the line, giving easy access to customers and workers.[11]

Growth like this, though, must be carefully planned by local development agencies. If the corridors chosen for rail construction do not match either the commuting patterns of workers or the areas amenable to future industry expansion, cities will end up with little more than expensive tourist movers paid for with government dollars.

Adam M. Zaretsky is an economist at the Federal Reserve Bank of St. Louis. Thomas A. Pollmann provided research assistance.

ENDNOTES

1 American Public Transit Association (1993), p. 17.
2 See APTA (1993), p. 19.
3 APTA (1993), p. 82.
4 APTA (1993), p.79.
5 APTA (1993), p.78.
6 See Schumann (1992) for more information about light rail in these cities.
7 APTA (1993), p. 51.
8 APTA (1993), pp. 44-45 and 51.
9 Ridership on commuter rail is more than twice as elastic in the long run as in the short run. See Voith (1991).
10 APTA (1993), p. 77.
11 APTA (1993), p. 76.
12 Although Washington D.C.'s Metro system only dates back to the mid-1970s, its heavy rail ranked No. 2 behind New York's subway in the number of unlinked passenger trips in 1992.

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