

Impact on Transit Patronage of Cessation or Inauguration of Rail Service

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Many theorists believe that transit service mode has little influence on consumer choice between automobile and transit travel. Others believe that they have noted a modal effect in which rail transit attracts higher ridership than does bus when other factors are about equal. Given environmental concerns and the large investment needed for guided transit, a better understanding of this issue is essential, especially for congested areas. A consideration of the history of automobile and transit travel in the United States can be helpful in comprehending the nature of the problem. After World War II, availability of vehicles, fuel, and tires spurred growth of both private automobile use and use of buses for transit. Analyses of the effects of both this growth and the improvements in rail systems that were added during the same period reveal that transit mode does indeed make a significant difference in the level of use of a transit facility. This factor must be included in future alternative analysis studies if reliable patronage determinations are to be made.

The purpose of this paper is to analyze what difference (if any) rail transit makes in attracting the public to use public transportation. Many metropolitan areas in North America suffer intensifying traffic congestion with no cure in sight, particularly in the suburban growth areas (1). At the same time, air pollution laws and problems require a radical reduction in emissions, with no assurance that much improvement can be accomplished. Diesel transit buses will be among the first vehicles to be affected by the Clear Air Act in 1991, but the necessary technology has not yet been perfected. Urban air is still not sufficiently healthful.

The expanded use of public transit can sharply reduce the use of automobiles and resulting pollution. The consumption of only 700 gallons of motor fuel per household in the District of Columbia and New York State, where there are significant rail transit services in addition to ubiquitous bus services, is evidence of this. States with the least transit service consume nearly three times as much motor fuel per household as do states in which rail transit predominates (2).

Most traffic- and trip-generation studies recognize no difference in trip generation attributable to the choice between rail and bus service, although recent work by R. H. Pratt and the Metropolitan Washington Council of Governments (3) demonstrates that recognition of the difference has begun. In estimating commuter rail patronage, Pratt found it necessary to increase rail estimates 43 percent over calculations for sim-

ilar bus service to calibrate models accurately for suburban transit use (4).

Earlier, the Delaware Valley Regional Planning Commission found that regional models calibrated for 99 percent confidence level grossly overstated local bus ridership and equally understated commuter rail ridership to obtain correct regional totals (5). There is thus considerable anecdotal evidence that transit submode choice can make a substantial difference in the actual attraction of motorists to transit, with widespread attendant benefits.

It is true that travel time, fare, frequency of service, population, density, and distance are all prime determinants of travel and transit use, but automobile ownership and personal income may not be consistent factors for estimating rail transit use for people with a choice. Most bus riders are heavily transit dependent, whereas subway passengers are less so. Railroad commuters are highly dependent on automobiles and high incomes to access and use rail service, and they do use it where it is of high quality (6). The same models do not appear to work accurately for the different transit submodes, but too few studies recognize the difference.

In this analysis, the historical secular trend in the transit industry from 1947–1948 to 1975 (when the statistical base was shifted to unlinked trips) will be examined first, to seek evidence of any differential in the rate of public use of public transit by submode. During this period, transit use fell from a post–World War II high to a low second choice for those who could not avoid it.

Next, case-specific changes from rail to bus service will be analyzed for cases in which data are available, with the aim of gaining a better understanding of the impact of these changes. Finally, changes from bus to rail service will be analyzed similarly. The results of these analyses will speak for themselves.

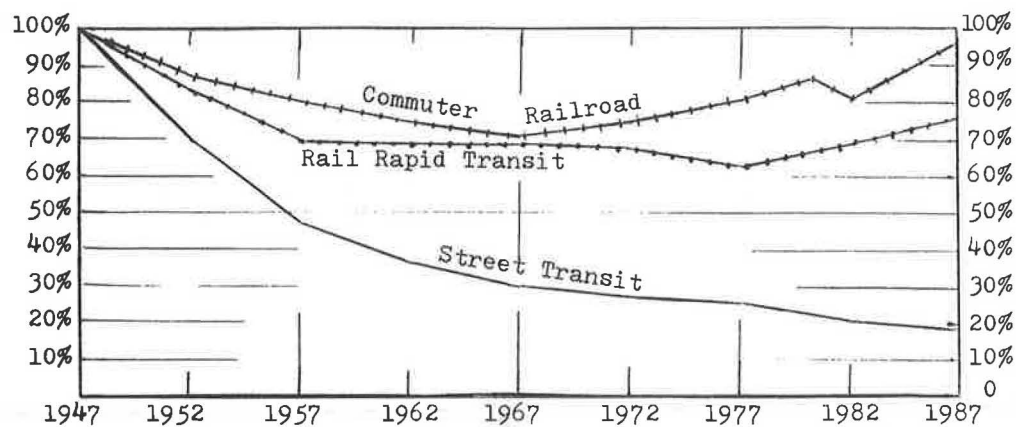
PAST TRENDS

After World War II, during 1947–1975, most transit systems were modernized to take advantage of less capital-intensive technology, expanding freeway systems, and suburban growth by substituting diesel buses for most electric railway services and some commuter railroad services. Electric railway vehicles in service declined from 36,377 in 1945 to 10,712 in 1975 (7). Commuter railroad coach requirements declined from an estimated 7,335 in 1945 to 4,438 (actual) in 1976. (An estimate had to be made for 1945 because railroads at that time did

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TABLE 1 CHANGE IN TRANSIT TRAVEL, 1945-1975

Year	Rapid Transit		Light Rail		Commuter Rail		Urban Bus		Suburban Bus		Total	
	Amount	Change (%)	Amount	Change (%)	Amount	Change (%)	Amount	Change (%)	Amount	Change (%)	Amount	Change (%)
Millions of Vehicle Miles in Service												
1945	458.4	—	939.8	—	222	—	1,855.6	—	(153)	—	3,475.8	—
1955	382.8	-16	178.3	-81	184	+2	1,886.4	-7	(142)	-7	2,631.5	-24
1965	395.3	+3	41.6	-77	159	-14	1,571.3	-17	(124)	-13	2,191.1	-17
1975	423.1	+7	23.8	-43	161	+1	1,541.3	-2	67	-46	2,216.2	+1
Millions of Passengers Carried												
1945	2,698	—	9,426	—	323	—	11,130	—	(895)	—	23,577	—
1955	1,870	-31	1,207	-87	258	-20	8,452	-24	(534)	-40	11,787	-50
1965	1,858	-1	276	-77	228	-12	6,119	-28	(334)	-37	8,510	-28
1975	1,683	-9	124	-55	260	+14	5,162	-16	161	-52	7,390	-13
Passengers Lost (in Addition to Service Cuts)												
1955		-15		-6		-22		-17		-33		-26
1965		-4		0		-2		-11		-24		-11
1975		-16		-12		+13		-14		-6		-14
Over 30 years		8 (cut)		97 (cut)		27 (cut)		17 (cut)		56 (cut)		36 (cut)
		38 (loss)		99 (loss)		20 (loss)		54 (loss)		82 (loss)		69 (loss)
Net		30 (loss)		2 (loss)		+7 (gain)		37 (loss)		26 (loss)		33 (loss)
Light Rail Plus Urban Bus												
Year	Millions of Vehicle Miles in Service		Millions of Passengers									
1945	2,795.4		20,556									
1975	1,565.1		5,286									
Cuts/losses	1,230.3		15,270									
Amount												
%	44		74									



SOURCE: APTA Fact Books

FIGURE 1 Trend of transit ridership, 1947-1987.

not uniformly segregate commuter from intercity requirements, as they now do.)

Passenger-miles traveled on shrinking commuter railroad systems declined 7 percent, from 5.6 billion in 1945 to 5.2 billion in 1975. During this same period, suburban bus systems lost 82 percent of their patronage, dropping from 895 million passengers in 1945 to an estimated 161 million in 1975. This loss was despite rapid growth in suburban population and bus service offered, as well as the abandonment of 7 of the 21 commuter rail systems (8).

Metropolitan bus services inherited many of the transit riders

left by the receding electric railways, but the number of buses in service declined from 53,381 in 1945 to 51,514 in 1975. In Table 1 and Figure 1, these trends are analyzed in 5-year increments to determine their characteristics. During this 30-year period, transit patronage fell 69 percent, forcing a 38 percent reduction in service. The decline in patronage was 31 percent greater than the curtailment of service, sharply reducing transit productivity in inflationary times—the worst of both worlds.

The various transit modes had different responses within the general trend. Light rail (or street car) service lost 98.7

TABLE 2 CHANGES IN TRANSIT SYSTEM USAGE, 1950-1980

1980 Popula- tion	Area	Change (%)	Current Passengers	Change (%)	Current Vehicles	Change (%)	WW II Rail (%)	Current Rail (%)	Old Habit	New Habit	Change (%)	Comments
6.78	Chicago	+25	484.9	-56	4,808	-21	90	65	261	72	-72	
3.81	Detroit	+14	52.0	-88	976	-66	41	0	208	14	-93	All bus
3.00	Toronto	+173	450.0	+46	2,609	+100	80	51	280	150	-46	50% rail
2.68	Washington	+144	123.0	-67	2,050	-1	45	0	301	46	-85	All bus
2.76	Washington	+151	250.0	-32	2,284	+11	45	55	301	91	-70	50% rail
1.85	Saint Louis	+15	37.7	-85	773	-52	58	0	155	20	-87	All bus
1.81	Pittsburgh	+2	68.8	-69	1,064	-26	82	6	155	38	-75	Some LRT
1.75	Cleveland	+19	75.7	-69	828	-42	76	20	191	34	-82	
1.61	Atlanta I	+92	76.4	+12	900	+102	78	0	122	47	-61	All bus
1.61	Atlanta II	+92	100.9	+47	990	+122	78	51	122	63	-48	New rail
1.56	Dallas	+188	28.6	-69	723	+50	58	0	169	18	-89	All bus
0.72	Ottawa	+241	78.4	+185	793	+372	83	0	126	109	-13	All bus
0.67	Oklahoma C.	+168	3.8	-93	95	-55	34	0	175	6	-97	All bus
Summary of 26 areas												
	Median > 50% rail	+73	236.0	-44	2,446	-5	76	59	229	63	-71	
	Median 40-49% rail	+95	218.2	-41	3,339	+37	63	41	193	62	-68	Two cases
	Median 6-25% rail	+27	47.2	-70	697	-30	61	18	166	34	-80	
	No rail remaining	+109	34.0	-75	748	-11	65	0	164	21	-87	

NOTES: Population and annual ridership in millions. Percentage of rail service is based on percentage of passenger-miles travelled. Sources: UMTA Section 15 Reports, *Mass Transportation Directory*, Kenfield-Davis, Chicago.

percent of its passengers, primarily because of the 97.5 percent reduction in service when buses were substituted for rail cars. From a reciprocal point of view, 2.5 percent of the rail service remained, carrying 1.3 percent of the passengers, a loss of 48 percent over 30 years. Bus service, which inherited most of the rail ridership, lost 54 percent of its 1945 riders, despite the rail riders added to bus over that period. Considering that new buses on improved highways often replaced worn-out street cars on bad track, the overall result is disconcerting and may help to focus on the transit's loss of market share.

In contrast to these bus rider losses (75 percent, if street car and bus passengers are grouped together), rail rapid transit lost only 30 percent of its riders during the same period. Nearly half of these were lost around 1952, when the financial community stopped Saturday work. (Saturday had been the highest ridership day of the week.) Commuter rail lost only 20 percent despite the loss of one third of its lines and the loss of much Saturday travel. It lost only 7 percent of its passenger-miles as the suburbs grew farther out and a lower-income population filled the inner suburbs.

These data are much too generalized to allow anyone to draw sound conclusions, but they do suggest that bus transit may not be able to hold or sustain the same market share as rail transit, if other factors are equal or similar. Few would suggest that service in which a new motor coach replaces a worn-out street car would cost more, run less frequently, or be slower. A more case-specific study of this phenomenon may be required because it appears that there is a difference in ridership (Table 2).

CASE HISTORIES

Bus and Oil Affiliates

Transit systems in Baltimore, Chicago's North Shore suburbs, Kansas City, Los Angeles, Milwaukee's suburbs, the Twin Cities (Minneapolis-St. Paul), New Jersey, Oklahoma City,

Philadelphia, and St. Louis were all affiliated with bus manufacturing or oil marketing companies for the specific purpose of replacing rail service with buses. In 1948 these properties operated 7,574 rail cars and 7,142 buses serving 1.9 billion revenue passengers per year. By 1986, these figures had declined to 1,700 rail cars and 11,875 buses serving only 793 million revenue passengers (estimated from unlinked trips and passenger revenue), a decline of 60 percent. Productivity per vehicle declined 55 percent. If the huge population growth in Los Angeles is excluded, the other systems declined 68 percent in revenue passengers.

In Baltimore, a 5-cent fare was promised when the new management began to replace the rail cars with buses, but instead fares increased, just as they did elsewhere. In the North Shore suburbs of Chicago, commuters fought to save their rail lines and opposed the use of buses. When the trains stopped, no buses took their place.

In Kansas City, the president of the Association of Commerce warned that the conversion of the important Country Club rail line would harm downtown business, and indeed it did. Later, Seymour Kashin, Assistant General Manager of the Transit Authority, reported that the Troost Avenue rail line, extended in 1946, carried more passengers than the entire bus system now does.

In Los Angeles, the last interurban rail line carried 5.2 million annual passengers in 1961 before it was replaced by a Freeway Flyer and a local service bus line. These bus lines carried 4.1 million passengers the first year, down 21 percent, and only 3.8 million passengers in the second year, down 26 percent, despite the more frequent service. This rail line is now being restored and is expected to carry 10 to 12 million passengers annually. The population growth in the area accounts for some of the expected increase.

In Minneapolis-St. Paul, the top managers involved in the rail-to-bus conversion were sent to prison as ridership fell. New Jersey suffered one of the sharpest declines in annual rides per capita—except for its one remaining light rail line, which has lost no significant number of passengers over the

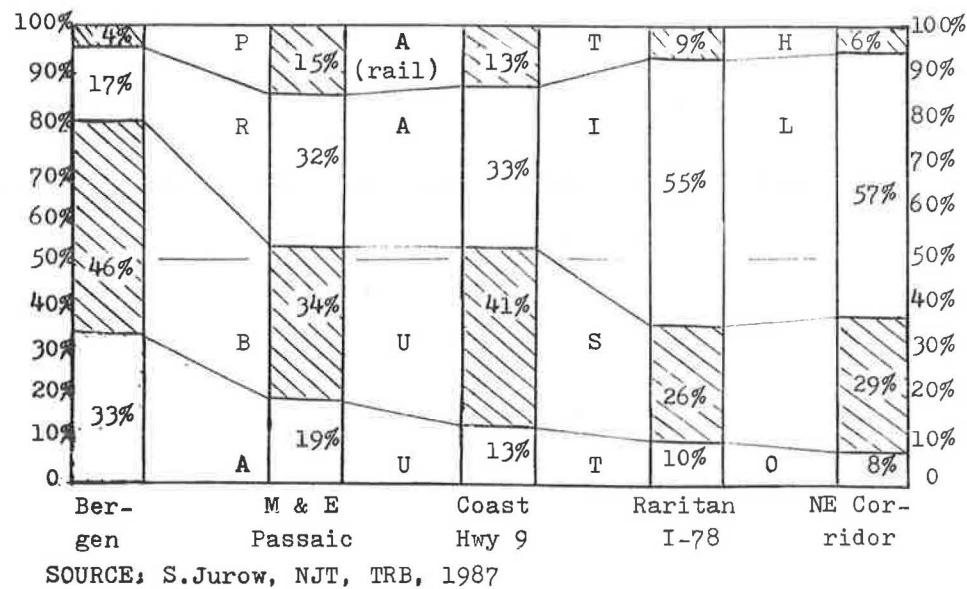


FIGURE 2 Submodal split across the Hudson River, New Jersey.

past 35 years, despite the sharp population decline in Newark where it operates. In Bergen County, New Jersey, which has an exclusive busway into New York City, transit has a lower modal split than in any other part of the commuting area. The split is even lower there than it is where the commuter rail lines end at the New Jersey waterfront, requiring a transfer at \$1 to cross the river (Figure 2).

In the western Milwaukee suburbs, when new buses replaced the old rapid transit rail line in 1951, ridership dropped 54 percent over a 2-yr span. Bus running time was 10 minutes longer than rail at that time, suggesting a loss of 21–22 percent of the riders. The balance of the loss, however, must be attributed to the mode (9). At the Waukesha rapid transit station, when buses were loading at the rail platform ahead of the rail car or train, only 26 percent of the passengers chose the bus, despite the 20 percent lower fare. It is probable that the lower fare offset the longer time, leaving the low modal share to passenger preference (10).

After rail service was eliminated in Oklahoma City and its environs, transit use fell 97 percent on a per capita basis. In St. Louis, with all-bus service, only 13 percent of the riding habit remains. St. Louis has now contracted to restore rail transit on a Metrolink from the airport through downtown to East St. Louis to recover some of the transit market share.

At one time, St. Louis was a leader in the transit industry. In their 1959 Annual Report, St. Louis Public Service Co. management wrote that

our company proposes to acquire the usable assets of certain other suburban bus operations and to purchase 125 additional luxury buses, 75 for street car conversion and 50 for revitalization of the county system. We would air-condition another 100 buses in our present fleet.

The report quoted the company's consultant:

St. Louis Public Service has made an outstanding contribution to the industry and to the St. Louis area by trying out new methods of attempting to attract patronage. At the present time, the St. Louis area is enjoying the largest fleet of air-conditioned buses in the country. The Company has experi-

mented with shorter headways in an effort to attract patronage. These and other promotions place this Company very high on the list of progressive operating managements.

Despite these comments, patronage was down 44 percent from 1947 as the rail service was cut back in favor of buses on freeways. The company sold its remaining rail cars to San Francisco, where ridership has held up more effectively. By 1986, transit in St. Louis was at a very low ebb (11). The losses would be even greater if the interstate electric railway had been included in the data.

In Philadelphia, which has trunk subway lines, bus substitution was limited to surface rail lines, and even these retain some rail operation. One rail-to-bus substitution was conducted as a trial. Ridership on route 42 dropped off markedly, and now, with an exclusive busway in Center City, it is only 33 percent of rail volume. During the trial, the Schuylkill River bridge was rebuilt without tracks, so rail service could not be restored even though the test was a failure (12). This was not a failure of coordination, but a highway engineer's strategy, abetted by the new owners of the transit system.

Between 1954 and 1956, the new management of the Philadelphia Transit Company purchased 1,000 new diesel buses to replace some old gasoline buses and many rail cars. During the installation of these new buses, passenger revenue fell 14 percent, as shown in Figure 3. Overall, from 1948 to 1988, transit travel in Philadelphia declined 63 percent, with most of the decline during the conversion from rail to bus.

Holding Company Dissolution Act

Transit systems in Atlanta, Milwaukee, Portland (Oregon), Pittsburgh, Tampa, and Washington were part of utility companies that also sold electric power. They were ordered by the federal government to dispose of either their electric power or transit business. It was deemed illegal for a utility company to provide both power and electric transit services.

During the Great Depression, it was not possible for the

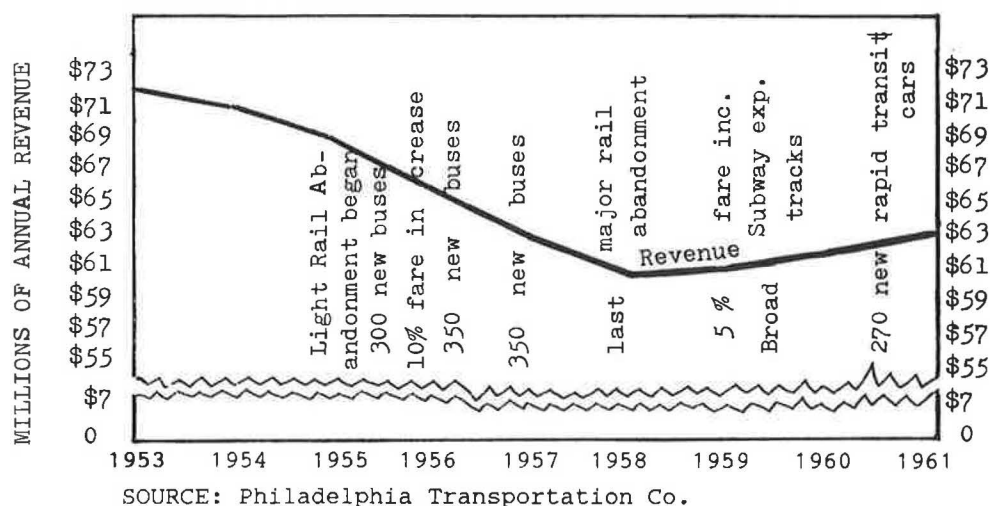


FIGURE 3 Philadelphia ridership with 1,000 new buses.

companies to sell their transit properties. Milwaukee spun its transit system off from the power part of the business by sending new shares of stock to the stockholders, but the other systems waited until profits from World War II gasoline rationing put enough cash in transit coffers to attract buyers. In Atlanta, as the system was converted to bus, ridership fell despite excellent management, but plans were begun for rail rapid transit (Atlanta will be reviewed further in the bus-to-rail portion of this analysis).

Milwaukee

In Milwaukee, a consultant found that the substitution of buses for rail service increased ridership 100 percent from 1938 to 1943. Public review of the report cited gasoline rationing as the prime reason for this great increase, and a comparison with Pittsburgh disclosed that ridership gained even more there, with no rail-to-bus substitutions (13). A consultant suggested that the Wells Street line might be studied for rail modernization, but the study was never made, despite the large amount of new rail installed in 1950. Ridership in Milwaukee is now 70 percent below its post-WWII peak.

Portland

In Portland, as post-WWII conversion of rail lines to bus accelerated, ridership dropped 14 percent per year—one of the sharpest declines in the nation. The exception was ridership on the suburban rail lines before conversion. After the less-severe decline that occurred when Saturday was phased out as a workday, ridership began to grow again, paralleling the experience in Shaker Heights, Ohio. Then the highway department closed the bridge into downtown for repairs, truncating rail service short of downtown and requiring a shuttle bus to complete the trip. This depressed ridership severely (although not as severely as Portland's bus ridership) until a 33 percent fare increase was applied. Service was then discontinued in defiance of the Public Utility Commission. An appeal to the court was fruitless because the highway department had rebuilt the bridge without rails. Bus ridership con-

tinued its sharp decline, and by 1958, ridership was down 74 percent (14).

Pittsburgh

The Pittsburgh transit system was captured by stock speculators when the utility company had to sell. The speculators disbursed the modernization fund as dividends and left management to operate as best they could. Ridership did not begin to decline until a 20 percent fare increase in 1948, but an annual series of strikes in the 1950s rapidly dissipated ridership. A public authority condemned the property in 1963 and began a rapid rail abandonment program. With public subsidies, no further service curtailments were made, and ridership stabilized at 69 percent below the Great Depression level.

In recent years, two new exclusive busways have been built to speed bus travel. The South Busway opened first, parallel to one of the remaining rail lines. Ridership grew slightly during the 1980–1981 energy crisis, but by 1984, it had fallen off to a level lower than before the busway opened. The second busway, to the east, was completed in 1983. It provided a new EBA bus line, making ridership comparisons difficult, but the system load factor declined from 12 to 10.5 passenger-miles per bus mile despite the use of articulated buses on EBA. The promise of 80,000 passengers per weekday never materialized. Ridership is between 21,000 and 29,000 each weekday in the most densely populated area of the city and its suburbs (15).

Two rail corridors were retained in Pittsburgh, with a plan to convert one of them into an automated guideway, but opposition blocked this federally funded effort. The two rail lines continued to operate, with patronage increasing from 20,000 per weekday after World War II to 24,000 by the time that the rail system was disrupted for reconstruction. This trend was diametrically opposed to the rest of the system. An alternatives analysis determined that light rail service should be provided. A new downtown subway replaced street operation. Ridership increased to nearly 30,000 each weekday, with little change in travel time. Data compiled by Southwestern Pennsylvania Regional Planning Commission reveal that rail ridership 10 miles from downtown is at the rate of

39 annual rides per capita. Bus travel is at the rate of 10 in the South Hills and 19 in the north, where there is no rail service. The rail rate is the same as in the Philadelphia area.

Tampa

The Tampa Electric Company operated 100 rail cars in that city until the Tampa Utility Board refused to allow the transit property in the rate base, forcing it out of business. National City Lines, which also operated 37 buses in Tampa, took over the entire operation after the rail system's demise. Despite rapid population growth, ridership has fallen 60 percent with an all-bus system. Per capita ridership has fallen 81 percent (16).

Washington

The Capital Transit Company in Washington was forced to sell to scrap dealer Louis Wolfson after wartime profits made the sale attractive. Because of the order to sell, the company had not been willing to make the heavy rail investment that was essential to relieving congestion of its cars in front of the White House. Accordingly, it sought to replace Benning number 10–12 line rail cars with buses on different streets to relieve rail congestion. Public protests were overcome, and the change was made. Ridership began a 25-yr decline, forcing Wolfson to severely truncate Maryland service to keep solvent. This so angered the public that Congress revoked the franchise during a 2-month strike, forever banning rail cars from the city streets.

For a time, no responsible new operator could be found, but eventually the owner of Trans-Caribbean Airlines came forward with \$600,000 down and the promise to pay \$2.5 million cash in two weeks, as well as assuming the outstanding debt. He used the company's own cash to buy the system. This buyer then sought relief from the rail abandonment order, but to no avail. In 1963, rail service was terminated, and ridership continued to decline until the low point in 1973, 67 percent below 1948 levels, despite the opening of the Shirley busway to suburban Virginia. In 1976, rapid rail transit came to the area, and ridership has doubled, as will be reviewed further along in this analysis.

Political Interference

Several rail transit systems were forced out of business by overpowering political pressure.

Chicago

In Chicago, a public authority took over the nation's largest street railway in 1947 and immediately began to cut back on rapid transit branch lines and eliminate all street railway lines, despite the presence of 600 brand-new cars. Fares escalated as fast as ridership declined. From 1948 to 1970, the decline was 63 percent. During the same period, rail rapid transit ridership increased 7 percent (17).

A comparison of 1960 data with 1970 data reveals a decline

of 30 percent on the new city bus system, a suburban bus decline of 36 percent, a rapid transit decline of 6 percent, and a satellite bus decline of 71 percent. Commuter rail ridership increased 7 percent (18). In Chicago's western suburbs, the Chicago, Aurora & Elgin Railway was forced to eliminate its direct service into Chicago's Loop so that construction of I-90 would be simplified. Commuters were required to transfer in Forest Park to the Chicago elevated railway on street trackage through the construction zone. Suburban ridership dropped 50 percent, half due to the forced transfer and one fourth each due to slower trip time and higher fares. Without the higher through trip revenue, the railway could not cover its expenses, and it had to shut down in 1957.

Leyden Motor Coach moved in to provide the service but was unable to attract sufficient patronage to support a bus line. In 5 yr, ridership of 7 million annually was completely eliminated (19).

Montreal

The Montreal Tramways Company, the largest transit system in Canada, was taken over by the city for the express purpose of eliminating the company's 994 rail cars. The resultant loss of ridership and profitability reduced Montreal to the second largest transit system in Canada, but ridership did not fall as sharply as it did in the United States under similar conditions. In 1967, a new subway system was opened and attracted high ridership, but not as high as that of Toronto's more rail-oriented system. Annual per capita transit revenue is \$63 (Canadian dollars) in Montreal, and \$116 in Toronto, where fares cover 68 percent of operating costs. In Montreal, the coverage is only 46 percent. The transit modal split downtown is 55 percent in Montreal and 70 percent in Toronto, with 54 percent of the passengers on rail cars. Montreal is 59 percent bus. Ridership in Toronto continues to increase (20).

Cincinnati

After World War II, the Cincinnati Street Railway modernized its system with new rail cars and infrastructure, as directed by the city. The next City Council reversed the policy by ordering removal of all rail service (21). The financial losses from the abandonment of nearly new rail facilities forced frequent fare increases on the riders, until it became the first major city to have a 55-cent fare. The ridership decreased 88 percent during 40 yr.

Detroit

Detroit had eliminated all electric railway service by 1956, along with much of the ridership. The General Manager's report in 1957 promised that "This was certainly a major step in the program of rehabilitating Detroit's transit system, making it possible to continue making improvements in transit service by expanding express operations via Detroit's growing expressway [freeway] system."

The rail cars that were replaced were relatively new, fast, and profitable, with fares covering 148 percent of operating expense. Bus revenues at the time were only 107 percent of

operating expense and declining. The ratio is now only 30 percent, despite one of the nation's first \$1.00 base fares. Ridership has declined 88 percent since 1947 (22). With the loss of its transit riders, the city has lost its last major downtown department store. Recently, a new elevated rail loop has been built downtown, but it provides little home-to-work service. It was built to connect with a light rail line that has not been funded.

Dallas

The Dallas Railway & Terminal Company began a rail modernization program after World War II, when ridership was 91 million (in 1948). The company was forced to agree to eliminate all rail lines as a condition of approval for a needed fare increase. With only two major rail lines remaining in 1954, ridership was down to 73.5 million. By 1957, all rail lines were gone, along with 52 percent of the system's ridership in a growing area (23). By 1981, revenue passengers (linked trips) were down to 29 million, an overall loss of 59 percent. The decline in riding habit was 89 percent.

Buffalo

In Buffalo, a similar agreement between the transit company and the city mandated the elimination of rail service, which was not modern. The company boasted that "Buffalo leads all cities of a half million or more in progress toward complete bus substitution. Nearly 70 percent of all IRC passengers are served by bus." Apparently, the bus service was not very good. Ridership began to decline in 1944, before the end of gasoline rationing, just as happened in Detroit. When war restrictions on fuel were lifted, all rail service was abandoned, and the company soon went bankrupt.

It was reorganized as the Niagara Frontier Transit Co. and was ably managed by Roswell Thoma for several years, but the decline in ridership slowed only briefly. By the time that light rail transit was restored to Main Street, system ridership had declined 82 percent from the 1944 peak (24). In fairness, however, it must be noted that key employers were lost to the city during this period, causing a marked decline in population.

Eastern Pennsylvania

Rail service to Reading, Pottstown, and Pottsville, Pennsylvania, was ordered to shut down by the state Department of Transportation in 1980, in outright violation of the Public Utility Law. Capitol Bus Company (Trailways) was then operating five round trips, in direct competition with seven rail round trips out of Philadelphia. Bus and rail combined served 1,800 weekday passengers at that time. The bus service was expanded 40 percent to cover loss of the trains, but there was no need to do so. Only 200 weekday bus passengers remain on the route, a loss of 89 percent over three years. The local buses are 20 minutes slower than the trains, and express buses bypass local stations. Considerable loss therefore might be expected, but nothing like 89 percent. This severe loss parallels an earlier loss in the nearby Allentown corridor.

Company Policy

Eastern Pennsylvania

In 1951, Lehigh Valley Transit Co. abandoned its hourly electric railway service between Allentown and Philadelphia's western suburbs. It continued its motorbus pool service in coordination with Reading Transportation Co., providing eight round trips between Allentown and downtown Philadelphia. Reading Railway also provided six round trip trains that made local stops. The electric railway was the only one serving Norristown en route, but at a time penalty, plus a transfer to reach the center of the city. No meaningful bus service replaced the hourly rail service. Extra sections were added to any existing bus trips that required them—but few did. Rail passengers just disappeared. Total travel by transit in the corridor declined from 1,600 per weekday with two rail lines and one bus line to 1,000 without the electric railway, then down to 240 after the state Department of Transportation ordered discontinuance of all rail service. This is an overall decline of 87 percent (25).

West of Philadelphia, one of the last privately owned transit companies, the Philadelphia Suburban Transportation Company, operated suburban rail and bus service at profit. Two of their rail lines had been converted to bus in 1954. Both were single track. One was on the side of a state highway for 18 mi, and the other was near the main line of the Pennsylvania Railroad, which provided direct service to Philadelphia. As of 1954, the Company had lost no passengers (net) to the growing "automania," but the state highway department and the federal income tax provided strong incentives for the company to divest itself of its rail transit lines. The highway department wanted to use the longer line for land on which to widen its highway, which had once been a company-owned toll road.

The transit company planned new air-conditioned buses on the improved highway. Rail cars had to run in trains at peak hours to cope with the single track, so smaller buses could offer more frequent service. Very slight ridership gains resulted from this bus substitution, but only at first. The improved highway and suburban growth attracted too much automobile traffic, congesting bus movement. In an attempt to retain riders, buses were extended into Philadelphia to avoid the subway transfer at 69th Street, but riders did not prefer the "one ride." The service was withdrawn after a 2-year effort.

The other 4-mile line was a branch of the Norristown High Speed Line (Philadelphia and Western Railway), which provided local service every 20 minutes in coordination with express service to Norristown. The Norristown line got the 20-minute local service, except in rush hours. The Strafford branch was sold to the highway department for a US-30 bypass, against the company attorney's advice. An abutting property owner discovered his family's reversionary easement and took possession, so the transit company had to refund the sale price. At the same time, the bus substitution was not holding ridership: many bus trips ran nearly empty. Service had to be cut back, losing more riders. Eventually, only three rush-hour trips were left, and now these are gone. The story closely parallels the Chicago suburban experience.

In 1967, the company tried again, abandoning its Ardmore rail line on a median in Highway 3 and on private right-of-way, a total of 5 mi. Not a single favorable public witness appeared at extended public hearings, other than company

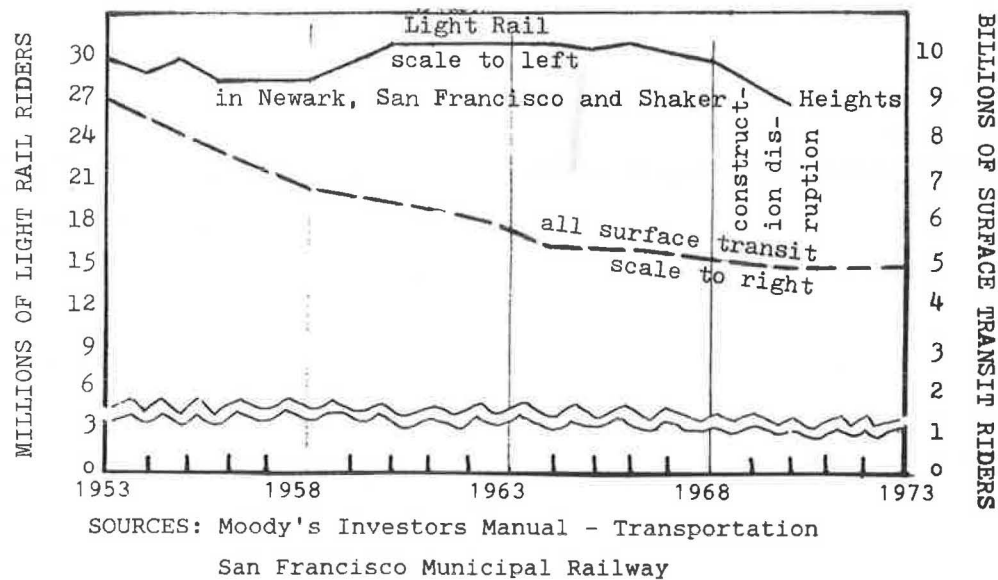


FIGURE 4 Trend of light rail versus bus ridership.

officials, but the Public Utilities Commission determined that only the company was competent to determine the matter (26). It had been shown that buses did not have the capacity of rail cars and that traffic congestion would impede buses, adding to bus costs and degrading service quality. The company countered with an offer to build America's first exclusive busway. It did. Again, a portion of the property was sold to the highway department, and crossing gates were provided for the busway. The rail line had none.

The opponents of this change were prophetic. Ridership fell 15 percent with the busway, despite more costly service. The crossing gates did not work well with rubber-tired vehicles. Neighborhood youths found the busway a good drag strip. No one benefitted except the company, which received an income tax refund for its rail abandonment and its sale of the entire system to a public authority for nearly twice its appraised value.

In 1956, John McCain, president of the company, promised to eliminate all rail operation before he retired. Since then, two remaining light rail lines have been improved with new cars, and the Norristown line is now having its 55- to 63-year-old cars replaced. Bus ridership keeps evaporating.

Cleveland

The city of Cleveland bought its transit system in 1942 and undertook a bus substitution program after World War II. By 1948, ridership was falling 14 percent per year, while ridership in neighboring Pittsburgh, with a similar economy, remained stable (27).

Cleveland's two independent light rail lines did not fare similarly. Cleveland undertook to build its own rail transit line, sharing the downtown portion of the light rail right-of-way. The system opened to travel in 1956 and extended westward until it reached the airport a few years later (see Figure 4).

At the same time, Cleveland replaced its city-owned street railways with buses, many express, for which the general man-

ager was recognized nationally by the Urban Land Institute. Despite the improved bus service, the decline in patronage did not stop. By 1986, the Greater Cleveland Regional Transit Authority, excluding the two light rail lines, had lost 72 percent of its riders since 1948. The two unchanged light rail lines had lost only 25 percent, despite the loss of the Saturday business day and despite the distant competition of the newer city rapid transit line, which has fared badly after an auspicious start.

UPTREND

Ottawa, Canada

Not all transit systems have suffered as greatly as those described. The most successful bus system on the continent is the OC Transpo in Ottawa, Canada, the nation's capital. By restricting free automobile parking, by practicing high-minded zoning controls, and by offering user-side subsidies to bus riders, OC Transpo has developed the highest all-bus riding habit on the continent. Aided by a population increase of 400 percent, transit ridership has increased 241 percent. This represents a loss of market share but is by far the best results of any major bus system.

To assist in coping with rapid growth and to update the transit system, Ottawa has built an expanding exclusive busway at a cost of several hundred million Canadian dollars. This project has not had the desired effect. Ridership that had been growing because of the transit incentives has begun to decline as the busway was phased in. Ridership is down about 25 percent, and rush hour local fares are up to \$1.60 (ridership data at this fare are not yet available) (28).

Atlanta

The loss of ridership in Atlanta has been described, but the introduction of rail rapid transit service has changed that sit-

uation. Atlanta now has two rapid transit lines, one extending north from the airport through Five Points (the CBD) to the northern suburbs, and the other extending west from east of Decatur to Hightower Road, a mile short of Atlanta's beltway, I-285. Markedly reduced fares have escalated back to typical rates, and ridership has grown with rail extensions. It is now 32 percent higher than it was 40 years ago, when nationwide ridership was at its peak, and has grown approximately 150 percent from the all-bus low in 1971. The reduced travel time made possible by rapid transit accounts for less than 50 percent of this growth. Rail rapid transit accounts for growth of more than 100 percent, a figure similar to the growth in the Lindenwold, N. J., corridor (discussed later).

Boston

Boston converted all of its local street railways to bus operation a generation ago, but the backbone of its service is a system of rail lines, including commuter, light rail, and rapid transit. As the number of rail cars was cut in half, ridership fell 66 percent over 40 years. The electric rail lines did not extend very far into the suburbs until recent years.

In contrast to this general trend, light rail transit was extended through the suburbs of Brookline and Newton to belt highway 128 in 1959. Originally a steam railroad, this system carried 3,140 passengers before it was converted to light rail. During the conversion, Middlesex and Boston buses attracted approximately 2,500 weekday riders with all-day service, a figure 20 percent less than the ridership for railroad's primarily rush hour service.

After light rail service began, 26,000 weekday passengers appeared. This 940 percent increase over shuttle bus volume and 728 percent increase over direct desultory railroad service threw schedules into disarray. Faster travel time and subway distribution in the hub accounted for a healthy portion of the increase, but rail transit was the primary attraction in this high-income, automobile-dominated area (29).

Toronto

Toronto is one of the very few cities to enjoy more transit riders in 1988 than in 1948. The urban area has grown markedly, but the city of Toronto has not. Absolute ridership has grown 46 percent during the past 40 years while other systems declined. The number of rail cars has increased with time and now exceeds 1,000. Streetcars continue to serve where subways have not replaced them. More than 50 percent of the area's transit work is done by rail. Since 1967, a new regional (commuter) rail system has been added, and new rail lines are being added as ridership continues to grow (30).

San Francisco

At the end of World War II, National City Lines acquired the Key System transit lines on San Francisco's East Bay and eliminated all electric transit operation. Ridership fell faster and farther than in any other major area, despite the express buses that replaced transbay rail service. In the city of San Francisco itself, the Municipal Railway held its patronage

better than did rail systems in most other cities. It retained electric transit operation, including streetcars on Market Street.

The people of the East Bay created a new transit district in an attempt to reverse their transit decline. A great improvement was made with public funds, but the modal split remained low. The citizens of the larger region then decided, by ballot, to restore rail transit to the East Bay and west to Daly City, with a new tunnel under the bay. The Bay Area Rapid Transit District began restored rail service in 1972. By 1975 "some 44 percent of BART patrons came from buses, over 20 percent was added to the number of daily trips in the . . . Bay area, and total non-BART trips by transit also increased" (31). Since 1975, BART travel has increased markedly, reaching a total of 210,000 weekday passengers. Travel on the light rail lines in San Francisco, partially parallel to BART, has increased 50 percent at the same time. In recognition of this trend, the area has funded seven rail extensions.

New Jersey

Northern New Jersey was once connected to New York City by ferry boats, two subways, and a railroad. When the highway tunnels and bridges were opened to automobile and bus travel (1926–1936), some rail travel was diverted, particularly in the off-peak periods. New Jersey then had the highest railroad taxes in the nation, which, with the Great Depression, forced a cutback of unsubsidized rail service. Several lines were totally discontinued, but bus ridership also declined. To improve bus service, the Port Authority of New Jersey and New York set aside an exclusive counterflow lane in the Lincoln tunnel with a 100-bay bus terminal in Times Square. Commuters have not been pleased with the congested operation.

Bergen County, New Jersey, with a million people, is across the Hudson River from the Bronx, New York. Many residents commute to Manhattan. One third pay high tolls and parking fees to drive in. Only 21 percent can use rail service because most of it has been eliminated. Buses serve 46 percent.

Essex, Morris, and Passaic counties in New Jersey still have much of their rail service. It does not cross the river, however, and the connecting ferries have been eliminated. Each rail commuter must pay an additional \$2 per round trip to cross the river on a crowded subway or on a bus. Despite this, 47 percent of the travel is by rail and 34 percent is by direct bus, leaving only 19 percent to automobile travel. The bus share dropped 26 percent as more rail service became available, and the automobile share dropped 42 percent (Figure 2).

From the North Jersey Coast, with some direct rail service, the rail share is 46 percent, and buses on the New Jersey Turnpike attract 41 percent. The automobile captures only 13 percent. From Union and Somerset counties (in the same rail corridor but without direct rail service), 64 percent of the commuters chose rail, 26 percent bus, and 10 percent automobile. On the spine of the Northeast Corridor, with all-direct train service to Manhattan, 63 percent of the commuters chose rail, 29 percent Turnpike buses, and 8 percent automobiles (32). It appears that the larger the share of bus travel becomes, the larger the share of automobile travel as well. Rail use in this area has increased 40 percent since 1983, suggesting higher rail shares than reported here.

In southern New Jersey, Port Authority Transit has con-

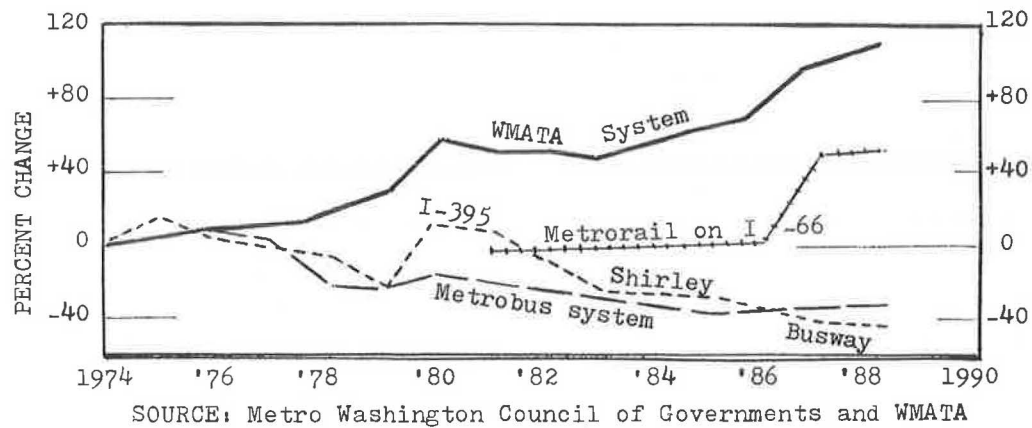


FIGURE 5 Transit trends in the Washington, D.C., area.

nected Lindenwold, New Jersey, with Philadelphia by rapid rail transit since 1969. Bus ridership in the area had been declining for years as the suburban population grew. With rail service added, ridership increased 115 percent. Bus service was continued but has gradually been reduced for lack of passengers. The PATCO rail line covered all operating and maintenance costs from fares at first, but the inflationary spiral has reduced the revenue-to-cost ratio to 74 percent in 1987. The bus ratio in this area is about half that figure.

Washington

In 1973, the Washington Metropolitan Area Transit Authority began serving the area's 123 million annual bus riders. In 1988, with more than half of the patronage back on rails, ridership had grown to 250 million, up 103 percent. Revenue is up 320 percent on fare increases of 67 percent. Rail passenger-miles exceed bus passenger-miles by 30 percent (transfer passengers not included).

About the time of the opening of the Lindenwold, New Jersey, line, the Shirley Busway opened on I-395, south out of Washington, for the same purpose over a similar distance. It was an immediate success. The Springfield, Virginia, area supported only three bus round trips per weekday before the busway. Now Springfield has service every few minutes in rush hour, with hourly service midday. Although the population of this region is similar to that of the Lindenwold line corridor, ridership is not. The riding habit in the Springfield area is 17 annual rides per capita, adjusted to 8.5 mi from the city center. The Lindenwold habit is 55. Ridership on the busway has declined 42 percent since the 1980 energy crisis as fares have increased and as car pools have been allowed on the busway (Figure 5).

In 1986, Metrorail opened an 11-mi line from Rosslyn to Vienna, Virginia, serving a corridor similar to the Shirley Busway but on I-66. With 2 years of travel development, Metrorail has attracted a riding habit of 51 (adjusted to 8.5 miles out), which is triple the bus rate. Rail running time is 22 minutes with 7 stations, whereas busway time is 20 minutes without stops.

Prerail express bus service in the I-66 corridor could not support any off-peak express service. The trains attract 500 passengers per hour from the outer stations. Local buses con-

tinue to parallel the rail line without much change. The rail revenue-to-cost ratio increased to 75 percent with the extension, with no change in fares. The bus revenue-to-cost ratio in Fairfax County was 24 percent before rail operation (33).

San Diego

San Diego resumed rail transit service in 1981 with a 16-mi line parallel to Bus Route 32, the area's busiest. The city had lost ridership rapidly when the original street railway was converted to bus after World War II. Despite rapid population growth and a stabilized bus system, ridership had fallen 53 percent before rail transit was resumed in 1981.

The Route 32 and Route 100 buses in the South Bay corridor served 12,000 weekday passengers. With rail service, Route 32 was truncated short of center city, and Bus Route 100 on I-5 was discontinued. The 15-min headways were unchanged during the period, but rail running time is only 40 min, compared with 75 min by bus. Initially, ridership was unchanged: 10,000 on the trains and 2,500 remaining on Bus Route 32. Rail ridership has been growing ever since, however, with 26,000 weekday passengers in 1988. A second short rail line has been added, bringing rail ridership to 29,500. The single-line increase was 160 percent in 7 yr, even though rail fares are higher than bus fares (except in center city). In the peak hour, at the maximum load point, ridership has increased 238 percent (Figure 6). Travel time savings could account for an increase of 92 percent. The balance of the increase may be attributable to rail service. The rail revenue-to-cost ratio is the best in the industry, and the cost per passenger-mile is the lowest (34).

Buffalo

When Buffalo's light rail line was completed, it attracted 30,000 school-day riders in the Main Street corridor. This is an 82 percent increase over previous bus service, some of which still operates. Faster travel time may account for 31 percent of the increase, and 3,000 rail trips are carried free downtown. About 34 percent of the ridership increase may be attributed to rail service. The chairman of the transit authority, Raymond Gallagher, stated that "What is gratifying is the increase

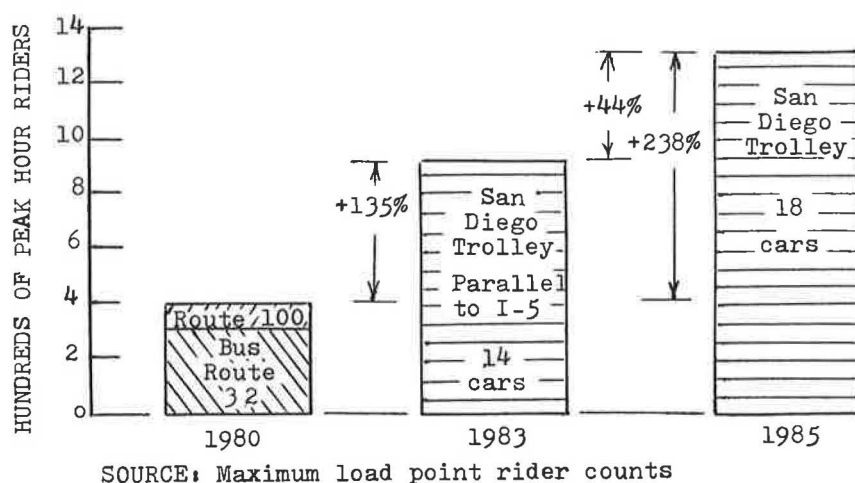


FIGURE 6 San Diego South Bay bus and rail ridership.

in ridership is not due to bus riders transferring to the rail system, but this new ridership increase is due to first-time riders who have never boarded a bus to get downtown" (35). The business community reported a 20 percent increase in downtown commercial activity as a result of rail service on this one line. Pittsburgh, Pennsylvania, and Portland, Oregon, reported similar results.

Portland

A 15-mi eastern radial rail line opened in Portland in 1986. Declining ridership on the all-bus system became increasing ridership on the new combination system. The cost per passenger declined. Light rail is now carrying 11 percent of the passengers on 4 percent of the service. The cost per rail passenger-mile is only 20 cents, compared to 40 cents by bus (36). The synergistic effect has now increased the number of bus riders.

Sacramento

With 15 million linked transit trips in 1986, the transit system of Sacramento, California, is one of the smallest to restore rail transit. One new light rail line, operating as two radials from downtown, is carrying 3.7 million annual passengers, 24 percent of the system's ridership on 13 percent of the vehicles. One fourth of the riders are new to transit, and many use suburban park-and-ride facilities. Service is too new to compile sufficient data, but 81 rail employees are producing 14 percent more passenger-miles per employee than bus employees (37).

CONCLUSIONS

In most cities served by buses exclusively, transit riding has declined 75 percent over the past 40 years. Exclusive busways have not made much difference absolutely, but they have helped relatively. In 11 areas with updated rail transit facilities, ridership has increased markedly, often by more than

100 percent. In two of these areas, the transit systems are attracting more ridership than they did when gasoline and tires were rationed. It appears that rail transit makes a great difference in ridership attraction, with attendant benefits (38).

Because transit use is a function of travel time, fare, frequency of service, population, and density, increased transit use can not be attributed to rail transit when these other factors are improved. When these service conditions are equal, it is evident that rail transit is likely to attract from 34 percent to 43 percent more riders than will equivalent bus service. The data do not provide explanations for this phenomenon, but other studies and reports suggest that the clearly identifiable rail route; delineated stops that are often protected; more stable, safer, and more comfortable vehicles; freedom from fumes and excessive noise; and more generous vehicle dimensions may all be factors.

Those engaged in alternatives analyses and similar studies would be well advised to consider these differential factors before making service recommendations or traffic relief assumptions. Future problems with air pollution, congestion, and funding may all be seriously affected by these considerations.

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