

NATIONAL REQUIREMENTS FOR URBAN PUBLIC TRANSPORTATION FUNDS

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The 1972 National Transportation Study was undertaken to assess the need and priorities for transportation capital funds for states and urban areas. This paper describes some of the results of that study with respect to urban public transportation. The results indicate that substantial funding is needed for urban public transportation in both the short and long term and that funding requirements vary widely between urban areas of different sizes and between urban areas of similar size. Capital funding requirements over time also vary. Major public transportation implementation programs peak in funding requirements midway in the programs. Operating costs as a proportion of total capital and operating costs are higher for existing public transportation systems than for new public transportation systems because existing systems are almost fully depreciated. Even with two-thirds federal funding for capital improvements, the state-local share of the 25-year cost to construct and operate urban public transportation systems is likely to be substantial.

●THE TRANSIT industry has been declining since the end of World War II. Figure 1 (1) shows the severe decline in annual revenue transit passengers and the sharp rise in fares since 1945. Transit fares have risen faster than the consumer index since 1965 (2).

The transit industry has been locked into a decline spiral that has been difficult to reverse. Decentralization of residences, jobs, and commercial activity has created a dispersed pattern of travel that is difficult to serve with public transportation, especially on a financially sound basis. In addition, rising incomes, major investments in highways, and poor transit service have led to significant increases in automobile ownership. Rising labor costs and operating costs have caused continuing increases in transit fares, which have further suppressed transit ridership. Figure 2 shows that, even if fares increase, costs increase faster than revenues.

However, patronage has declined less severely on rail rapid transit than on bus transit (Table 1), but deficits have been sizable (2). Rail transit systems accounted for 43 percent of the nationwide transit operating deficit in 1970 (3).

It is clear that the demand for and the environment within which urban transit operates have changed considerably within the last 20 years. However, it is not clear how the transit industry has perceived these changes and to what extent transit systems have been modified to adapt to these changes. There is little indication of changes in services, innovative approaches, marketing campaigns, or other efforts by transit operators in most urban areas to maintain and increase their share of the travel market. Further, most of the legal and institutional barriers to improving the efficiency and utility of public transportation still stand with little attempt to eliminate them.

The taxi industry has done much better. During the period from 1960 to 1970, annual revenue passengers dropped 20 percent on bus transit and 6 percent on rail transit but increased 31 percent in taxicabs (Table 1). In general, taxicabs operate under many of the same regulatory constraints as transit companies, have had increasing costs, and in some locations must carry a high-cost "medallion" burden as well. According to Wells et al. (4), the annual taxi revenue now exceeds the revenue of the total transit industry plus rail commutation even though taxis haul less than half

Figure 1. Average fare per revenue passenger from 1935 to 1970.

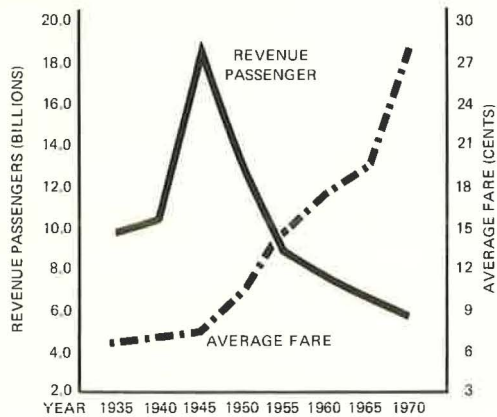


Figure 2. Transit revenues and expenses from 1961 to 1971.

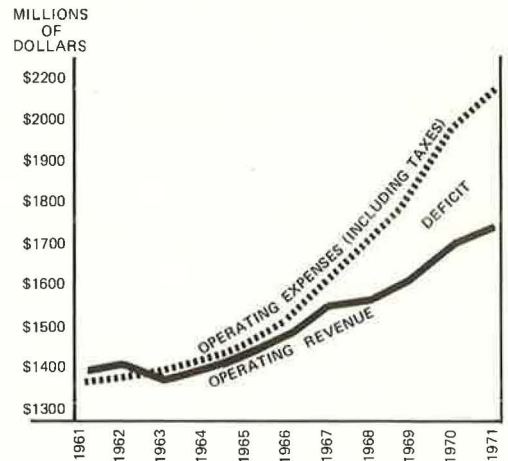


Table 1. Urban public transportation annual revenue passengers in 1960, 1965, and 1970.

Mode	Passengers (millions)			Percentage of Change From 1960 to 1970
	1960	1965	1970	
Surface rail	335	204	172	-43.7
Subway and elevated rail	<u>1,670</u>	<u>1,678</u>	<u>1,574</u>	-5.7
Total	2,005	1,882	1,746	-12.9
Commuter rail	248	233	247	-0.4
Trolley coach	447	186	128	-71.4
Motor bus	5,069	4,730	4,058	-19.9
Taxicab	1,820	1,960	2,378	30.7

Table 2. Urban public transportation operations in 1970.

Mode	Revenue Passengers (millions)		Passenger Revenue (millions of dollars)		Revenue-Miles (millions)	Vehicles (thousands)	Avg Employment ^d (thousands)
	Number	Percent	Amount	Percent			
Rail ^a	1,746	20.4	415	10.2	441	11	— ^b
Trolley coach	128	1.5	30	0.7	33	1	— ^b
Bus	<u>4,058</u>	<u>47.4</u>	<u>1,194</u>	<u>29.4</u>	<u>1,409</u>	<u>50</u>	— ^b
Subtotal	5,932	69.3	1,639	40.3	1,884	62	138
Commuter rail ^c	247	2.9	205	5.1	— ^b	— ^b	— ^b
Taxicab	<u>2,378</u>	<u>27.8</u>	<u>2,221</u>	<u>54.6</u>	<u>3,417</u>	<u>170</u>	<u>111</u>
Total	8,557	100.0	4,065	100.0	— ^b	— ^b	— ^b

^aIncludes elevated and subway rail rapid transit, grade separated surface rail, and streetcar operations.

^bNot available.

^cUrban passenger rail service provided by railroad companies.

^dTaxicab employment believed to be underestimated.

Table 3. 1970-1990 urban public transportation needs.

Type of Project	As of 1970		1970 to 1980		1980 to 1990		1970 to 1990	
	Amount	Percent	Amount	Percent	Amount	Percent	Amount	Percent
Bus	2,971	35	4,099	18	5,242	2	12,312	21
Rail	<u>8,620</u>	<u>65</u>	<u>19,159</u>	<u>82</u>	<u>22,232</u>	<u>98</u>	<u>50,013</u>	<u>79</u>
Total	11,591	100	23,258	100	27,476	100	62,325	100

Note: Amounts are in millions of dollars.

as many revenue passengers (Table 2). The transit decline may, therefore, be due in part to the character of its service.

1972 NATIONAL TRANSPORTATION STUDY

As part of the 1972 National Transportation Study, states and urbanized areas were requested to provide to the U.S. Department of Transportation information on their capital needs and separate statements of their program priorities under 3 federal program assumptions for urban public transportation (2, 5, 6, 7, 8). This comprehensive survey provides the first complete picture of the nation's needs for urban public transportation capital funds and the priorities for those funds. Further, these data on urban public transportation are placed in the context of the needs and priorities for capital funds for all transportation modes so that the relative needs of urban public transportation with respect to other modes can be assessed.

Data were requested for 3 time periods: as of 1970, 1970 to 1980, and 1980 to 1990. The capital improvement programs were requested for 2 time periods: 1974 to 1979 and 1980 to 1990.

PUBLIC TRANSPORTATION NEEDS

Table 3 gives a summary of the data on urban transportation needs provided by the states and urban areas as part of the 1972 National Transportation Study. The needs for capital funds for public transportation during the period from 1970 to 1990 for urban areas having populations of 50,000 and more are \$62.3 billion, 79 percent of which is for rail rapid transit projects (2, 5, 6). These estimates are unconstrained by any budget limitations or federal program requirements. Fifty-six percent of the rail projects and 58 percent of the bus projects occur in the first 10 years.

The highway and public transportation needs are given by urban area population group in Table 4. There is a wide variation in the percentage of public transportation needs that are for rail rapid transit. Larger urban areas show greater needs for rail rapid transit both in absolute dollar terms and as a percentage of public transportation needs. Rail rapid transit needs as a percentage of public transportation needs range from 22 percent for the 50,000 to 100,000 population group to 87 percent for the more-than-2-million population group; the nationwide average is 79 percent.

Table 5 gives the transportation needs for the urban areas having a 1990 population of 1 million or more. Those urban areas have the greatest needs for public transportation—92 percent of the national public transportation needs of which 85 percent is for rail rapid transit. Of the 35 urban areas in the more-than-1-million population group, 26 indicated some rail rapid transit needs and 10 indicated that more than 90 percent of these public transportation needs are for rail rapid transit. The data in Table 5 show the wide variation in urban public transportation needs; the percentage of total needs for public transportation ranges from 1 to 69 percent, and the percentage of these public transportation needs for rail transit ranges from 0 to 95 percent.

Table 6 gives the needs per capita by population group. Highway needs per capita do not vary greatly by size of urbanized area, but urban public transportation needs per capita sharply increase as urban area size increases. The total highway and urban public transportation needs per capita do not reveal a pattern by size group except for those urbanized areas having a 1990 population of more than 2 million. The higher overall investment needs per capita of these are largely due to their higher public transportation needs per capita.

The implications of these results are that urban areas have different needs for public transportation capital funds, and flexibility may be required in the apportionment of those funds on a nationwide basis.

PUBLIC TRANSPORTATION PRIORITIES

As part of the 1972 National Transportation Study, states and urban areas were asked to delineate capital improvement programs under 3 federal funding alternatives (2, 5, 7, 8). Two of these are discussed below.

Table 4. 1970-1990 transportation needs by mode and urban area population size.

1990 Population Group	1970 Population (millions)	Highway Needs*		Public Transportation Needs			Total Needs*
		Amount	Percent	Amount	Percent	Percent for Rail	
Less than 2 million							
1 to 2 million	18.4	24,439	82	5,395	18	55	29,834
500,000 to 1 million	13.3	15,899	86	2,598	14	33	18,497
250,000 to 500,000	10.5	16,402	94	1,043	6	18	17,445
100,000 to 250,000	10.3	15,357	96	708	4	21	16,065
50,000 to 100,000	6.5	8,624	94	522	6	22	9,146
Subtotal	59.0	80,721	89	10,266	11		90,987
More than 2 million	66.0	89,081	63	52,063	37	87	141,144
Total	125.0	169,802	73	62,329	27	79	232,131

Note: Amounts are in millions of 1969 dollars.

*Not including local roads or the cost of completing the Interstate System.

Table 5. 1970-1990 transportation needs by mode and urban area having 1990 population of more than 1 million.

Urban Area	1970 Population (millions)	Highway Expenditures*		Public Transportation Expenditures			Total Expenditures
		Amount	Percent	Amount	Percent	Percent for Rail	
Atlanta	1.17	1,548	54	1,301	46	92	2,849
Dallas	1.34	4,414	84	825	16	81	5,239
Seattle	1.34	2,189	84	419	16	0	2,608
Miami	1.22	1,102	69	487	31	91	1,589
Milwaukee	1.25	927	86	148	14	0	1,075
Cincinnati	1.20	1,312	75	434	25	0	1,746
Kansas City	1.10	1,231	70	534	30	92	1,765
San Juan	0.82	1,241	59	853	41	66	2,094
Phoenix	0.86	1,154	93	92	7	0	1,247
New Orleans	0.96	824	83	169	17	79	993
Denver	1.05	902	99	12	1	0	914
San Antonio	0.77	610	92	56	8	0	666
Columbus	0.79	534	75	181	25	23	715
Indianapolis	0.82	381	84	70	16	0	451
Buffalo	1.09	1,142	81	270	19	79	1,412
Louisville	0.74	929	85	165	15	0	1,094
Memphis	0.69	410	24	147	26	69	557
Portland	0.75	1,964	93	155	7	01	2,119
Fort Worth	0.68	2,738	88	361	12	94	3,099
Fort Lauderdale	0.61	435	94	27	6	7	462
New York	17.36	20,354	61	13,037	39	93	33,391
Los Angeles	9.31	9,872	59	6,873	41	83	16,745
Chicago	7.10	8,369	78	2,410	22	74	10,779
Philadelphia	4.30	8,315	73	3,153	27	94	11,468
San Francisco	4.01	5,201	50	5,101	50	85	10,302
Detroit	3.97	7,827	73	2,827	27	46	10,654
Boston and Providence	4.23	6,874	80	1,710	20	79	8,584
Washington	2.48	4,125	53	3,718	47	96	7,843
Cleveland	2.15	2,632	69	1,183	31	84	3,815
St. Louis	1.88	2,492	62	1,497	38	94	3,989
Houston	1.68	3,692	80	910	20	75	4,602
Minneapolis and St. Paul	1.70	1,135	57	866	43	92	2,001
Baltimore	1.58	1,949	36	3,450	64	94	5,399
Pittsburgh	1.85	3,449	73	1,273	27	87	4,722
San Diego	1.20	1,245	31	2,753	69	97	3,998

Note: Amounts are in millions of 1969 dollars.

*Not including local roads or the cost of completing the Interstate System.

Table 6. 1970-1990 transportation needs per capita by mode and urban area population size.

1990 Population Group	Highway*	Transit	Total*
Less than 2 million			
1 to 2 million	1,328	293	1,621
500,000 to 1 million	1,195	195	1,390
250,000 to 500,000	1,562	99	1,561
100,000 to 250,000	1,491	69	1,560
50,000 to 100,000	1,327	80	1,407
Subtotal	1,368	174	1,542
More than 2 million	1,350	783	2,139
Total	1,358	499	1,857

Note: Amounts are in 1969 dollars and are based on 1970 population.

*Not including local roads, or the cost of completing the Interstate System.

Table 7. Expenditures for capital improvement programs from 1974 to 1990.

Urban Area	Mode	Alternative 2		Alternative 3		
		Amount	Percentage of Total	Amount	Percentage of Total	Percentage of Public Transportation
All	Public transportation					
	Bus	7,965		8,650		28
	Rail	18,046		22,244		72
	Subtotal	26,011	20	30,894	23	100
	Highways	106,191	80	104,155	77	
	Total	132,202	100	135,049	100	
New York	Public transportation					
	Bus	634		703		10
	Rail	4,603		6,328		90
	Subtotal	5,237	35	7,031	47	100
	Highways	9,689	65	7,941	53	
	Total	14,926	100	14,972	100	
Chicago	Public transportation					
	Bus	472		474		32
	Rail	1,010		1,008		68
	Subtotal	1,482	25	1,482	23	100
	Highways	4,414	75	5,097	77	
	Total	5,896	100	6,579	100	
Los Angeles	Public transportation					
	Bus	673		659		50
	Rail	699		660		50
	Subtotal	1,372	14	1,319	16	100
	Highways	8,100	86	7,063	84	
	Total	9,472	100	8,382	100	

Note: Amounts are in millions of 1969 dollars.

1. **Alternative 2**—For fiscal years 1974 to 1978, and for fiscal years 1979 to 1990, all federally funded transportation programs are given that operate with existing legislative constraints, matching ratios, and funding levels. The matching ratio for all programs is $66\frac{2}{3}$ federal and $33\frac{1}{3}$ state or local or both.

2. **Alternative 3**—Funding levels are those authorized under existing legislation, with a matching ratio for all programs of $66\frac{2}{3}$ federal and $33\frac{1}{3}$ state or local or both and removal of legislated program constraints to permit transfer of funds among programs and into any transportation capital program. (Operating and maintenance costs are not included.)

Some of the information is given in Table 7. More total funds will be spent on highways and transit in urbanized areas under Alternative 3, the more flexible arrangement, than under Alternative 2. There are 2 reasons for this. The greater flexibility permitted some states to use more of the federal apportionments beneficially, and a slightly increased local matching percentage in some areas encouraged the states to spend more of their own funds to obtain all their federal apportionments.

A comparison of the 2 alternative capital improvement programs (Table 7) with the needs estimates (Tables 4 and 5) indicates that a lower amount of funds will be expended under the capital improvement programs than under the unconstrained needs estimates. The percentage that the capital improvement programs were of the needs was 50 percent for public transportation, 61 percent for highways, and 57 percent for total capital expenditures. For urban public transportation, a slightly lower proportion of funds will be expended on rail transit: 79 percent for the needs, 70 percent for Alternative 2, and 72 percent for Alternative 3.

Data in Table 7 also show how the increased flexibility was used by several of the largest urbanized areas. New York shifted large amounts into rail transit, in part, from highways. Chicago changed its public transportation expenditures very little. Los Angeles cut both programs, apparently choosing to spend its transportation dollars elsewhere in the state or for other forms of transportation.

These findings indicate that increased flexibility in the use of federal transportation funds will not cause major modal shifts on a national basis. However, the increased flexibility will be used by individual urban areas to better tailor transportation investments to local objectives.

TIME PHASING OF TRANSIT EXPENDITURES

In addition to the level of capital needs, time phasing of these needs must be investigated to understand the nationwide requirements for capital funds for urban public transportation. The phasing of public transportation expenditures over time requires that 2 issues be examined: (a) time phasing of an implementation program within individual urban areas and (b) time phasing of requirements on a national basis.

Figure 3 shows actual and planned annual expenditures of a major transit implementation program, which is typical of similar programs in other areas. Expenditures during the life of a major transit implementation program are not uniform, but tend to reach a peak in the middle years, which can sometimes represent 7 times the expenditures in the early or later years. This indicates that the demand for funds for individual urban areas will vary considerably over time.

Table 8 gives some additional information on major transit implementation programs in several urban areas. The data suggest that, if several urban areas carry out major implementation programs during the same time period, the annual requirements for public transportation capital funds on a national basis could and likely would vary considerably.

OPERATING COSTS OF NEW TRANSIT SYSTEMS

Table 8 also gives the total capital cost of new transit systems and the costs to operate those systems for a 25-year period (depreciation is excluded). The 25-year operating costs range from about 27 to 80 percent of the capital costs. The operating costs must be paid for by revenues and, where necessary, supplemented by state or local tax sources. If the federal contribution is $\frac{2}{3}$ for capital costs and none for

Figure 3. Phasing of public transportation program in Atlanta.

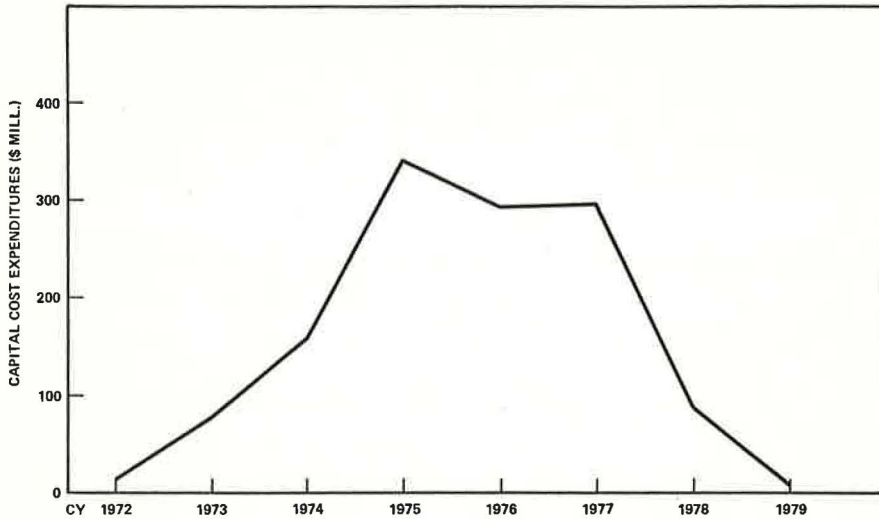


Table 8. Major transit implementation programs.

Urban Area	Start of Program	Year of Maximum Funding Requirements	Type of Transit Program	Total Capital Cost	Total Operating Cost for 25 Years*
San Francisco	1962	1967	Rail	1,527	575
Washington, D.C.	1968	1975	Rail	2,980	800
Miami	1972	1976	Rail	391	311
Atlanta	1972	1975	Rail	1,271	—
Baltimore	1973	1976	Rail	656	—
Buffalo	1971	1974	Rail	277	143
Dallas-Ft. Worth	1974	1976	Primarily rail	2,000	—
Puget Sound	1974	1980	Bus	97	—
Milwaukee	1974	1980	Bus	151	101

Note: Costs are in millions of dollars.

*Does not include depreciation.

operating costs, the local area must cover between 47 and 63 percent of the total capital and operating costs for 25 years of system operation.

OPERATING COSTS OF EXISTING TRANSIT SYSTEMS

The split between capital and operating costs of new systems is quite different from the split for existing systems. Existing systems are almost fully depreciated, and the variable portion of the operating costs (i.e., total operating costs less depreciation and amortization) dominates the capital input.

The variable cost of existing public transportation systems represents a major portion of their total operating cost. In 1970, the median cost of operating a bus transit system ranged from 63 to 85 cents per vehicle-mile; the higher costs were for the larger systems (4). Of this cost, approximately 93 percent was variable costs and 7 percent was depreciation and amortization (4). Since these figures are from data on current operations, the depreciation and amortization are probably understated.

The 1970 operating cost for existing urban rail systems ranged from 85 cents to \$2.15 per vehicle-mile (4). The wide variation in rail operating costs is due to a number of factors including labor costs, operating conditions and efficiencies, demand conditions, and accounting procedures. Depreciation ranged from 3 to 17 percent of

operating costs for those systems that keep a depreciation account. These depreciation accounts probably understate the annual amortization of capital because the majority of existing rail plants are old and fully depreciated in an accounting sense.

Clearly the variable cost of existing urban public transit operations represents the largest portion of operating costs. This is an important consideration in determining policies and programs for rail transit. The most recent rail system, the Lindenwold Line, achieved profitability after 4 years of operation (4). How other new systems will do financially remains to be seen.

CONCLUSIONS

Public transportation continues to decline in terms of revenue passengers while taxicabs attract increasing ridership. This may indicate that taxicabs are providing the type of service that is more attractive to the public.

The urban public transportation capital needs from 1970 to 1990 are substantial and highly variable among urban areas of different sizes and among large urban areas within the same size group. There are substantial capital needs for urban public transportation, particularly rail rapid transit.

About half as much urban public transportation expenditures will be programmed under current federal funding levels as under the unconstrained needs estimates; rail transit systems will have a slightly lower proportion. This does not necessarily mean that the earmarked transit funds should double. Under a flexible federal funding policy, urban transportation funds for public transportation will slightly increase on a nationwide basis, directed for the most part for rail transit. A flexible federal funding policy will allow individual urban areas to better tailor their transportation programs to their individual needs.

The need for capital funding of major urban public transportation programs varies considerably during the implementation of the programs. If several urban areas implement programs during the same time period, the annual requirements for capital funds on a national basis for public transportation are likely to vary considerably over time.

The costs to operate new rapid transit systems are likely to be considerable, ranging from about 30 to 80 percent of the 25-year cost of construction and operations for a sample of urban areas. The proportion that operating costs are of the total cost of existing rail transit systems is considerably higher than for new rapid transit systems in that these existing systems are almost fully depreciated.

Even with two-thirds federal funds for capital improvements, the state and local share of the 25-year cost to construct and operate public transportation systems is likely to be substantial.

The 1974 National Transportation Study is collecting data on plans and programs for transportation by the states and urban areas. These plans and programs, in contrast to needs and priorities in the 1972 study, will likely produce a more accurate picture of the national requirements for urban public transportation funding.

ACKNOWLEDGMENT

The views expressed in this paper are solely those of the author and do not necessarily represent any policy or position of the U.S. Department of Transportation.

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