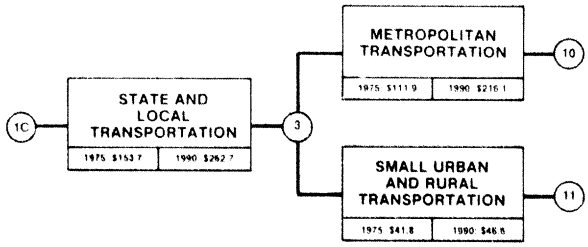
PART D
State and Local Transportation

INTRODUCTION

The 1975 Statement of National Transportation Policy by the Secretary of Transportation outlined his policy concerning Federal, State, and local relations. It states:

> "The Federal interest in interstate and international transportation is mandated by the Constitution and defined by practical requirements of uniformity and connectivity, and, in addition, for international transportation, such Federal interest is circumscribed by international law and foreign policy. In recent years, laws have been enacted on mass transit, environmental quality and energy conservation which are as concerned with local transportation as they are with interstate and foreign commerce. These laws have expanded the definition of Federal interest and require extensive cooperation among Federal, State and local governments.
>
> "Now, we must seek a more rational delineation of responsibility among the levels of governments. Most transportation activity involves primarily local movement. Consequently, the largest share of existing Federal assistance programs requires shared Federal, State and local priorities and decisionmaking. The extent of Federal financial participation and program control is a function of the national priorities served. As we decentralize authority and increase State and local program flexibility, States and localities must improve program management and, where possible, increase their financial participation in projects that primarily benefit their residents. We have a further responsibility to define residual Federal interests—connections to interstate commerce, preserving urban centers, overall national economic and social well-being, civil rights, etc.—and to simplify the process by which responsiveness to these national priorities is assured."

Roughly half of the Nation's total expenditures for transportation are used to move people and goods locally, in trips of 30 miles or less. As figure D.1 shows, local transportation for purposes of this examination has been categorized as either metropolitan[1] or small urban and rural. The Standard Metropolitan Statistical Area map, found in the envelope inside the back cover of this book shows the split of the nation's land between these two categories as of 1975. State and/or local governments have traditionally planned and funded a large portion of the investment for public facilities and services serving local transportation. Their role is expected to increase.



Note: The amounts shown are the transportation bills for 1975 and 1990 in billions of dollars.

NOTE: The 1990 figures do not include State and local expenditures to prevent abandonment of uneconomic branch lines.

Figure D.1. Transportation Tree.

In developing this part of the document, it has been assumed that State and local governments can best judge what transportation will best serve their constituents. Thus, the reported intentions of State and local governments are summarized and presented. However, State and local governmental expenditures account for only a minor fraction of the total national expenditures for local transportation, when compared to private expenditures. Thus, before presenting such State summaries, it is useful to put them in context by reviewing the emerging issues, trends, and forecasts for local transportation.

[1] A standard metropolitan statistical area is defined essentially as a county containing a central city of over 50,000 population plus any adjoining counties having suburban characteristics, particularly in regard to commuting to the central county (see fig. D.2).

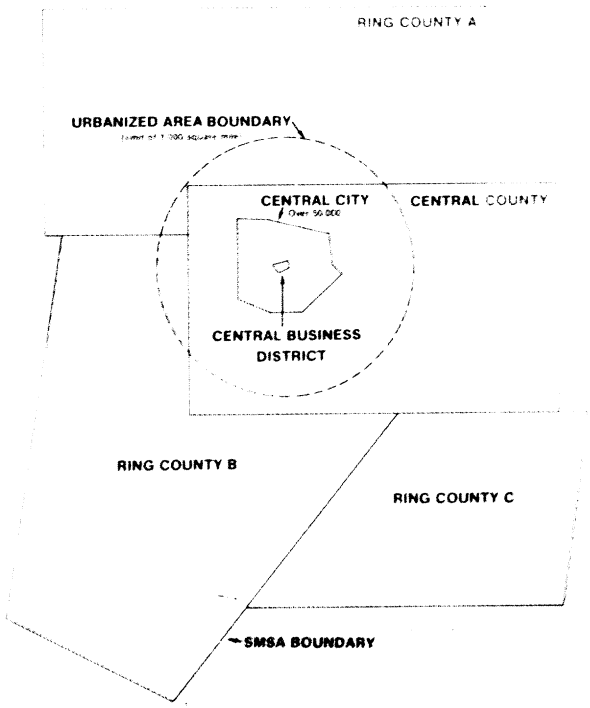


Figure D.2. Metropolitan Area Elements.

CHAPTER XI
State and Local Transportation

EVOLVING STATE TRANSPORTATION ROLE AND ISSUES

The Evolving Metropolitan Area Relationship

Recent changes in Federal regulations have increased transportation planning requirements at the local level. The Department of Transportation regulations require State Governors to designate a Metropolitan Planning Organization for each urbanized area as the forum for cooperative decisionmaking by principal elected officials of general purpose local government. This will necessitate greater cooperation between State transportation agencies and local jurisdictions in the future. Transportation requirements serving interstate and other nonmetropolitan goals will have to be resolved within the context of metropolitan system requirements and local transportation objectives.

State agencies are also being approached with increasing frequency to share in meeting the growing operating deficits of metropolitan public transit systems. While this is a somewhat recent phenomenon in most States, it is likely a permanent and expanding one. In many instances, State transportation agencies and officials will have to alter in significant ways their traditional view of the State role. Considered a purely local problem heretofore, more and more State agencies are increasingly concerned with the continued viability and service of local public transportation, both in metropolitan and rural areas, as essential elements of responsive transportation serving the States' citizenry. The State role will increasingly expand to include the local mobility needs of individuals throughout the State. Further, State government will be challenged to distribute its limited financial resources among an enlarging number of geographic, modal, and program alternatives. These growing demands will place increasing burdens upon State agencies to make economically sound resource allocation decisions. It is clear that State governments must play a major role in responding to metropolitan and other local transportation issues.

Rural Public Transportation

The growing demands upon State transportation agencies to address metropolitan area problems are paralleled by a growing awareness of mobility deficiencies in rural and small communities in a number of States. While this phenomenon is not new, it has been attracting increasing attention as a result of several coinciding trends. The movement of many young people from rural areas to cities has left many of our Nation's smaller communities and rural areas with an aging population which is increasingly dependent on publicly provided transportation. Furthermore, intercity motor carriers in some instances have reduced the frequency of service provided to smaller communities partly because such service, largely unprofitable, is also inconvenient, requiring, as it does, exiting from the major Interstate Highway routes.

The results of a recent study of the change in service to smaller and medium-sized communities indicate that the availability and frequency of rail service have declined steadily since 1950. Air service has shown a change in character as commuter carriers have replaced trunk and regional carriers at many of these communities, often with increases in service availability and frequency. (See chapters VII and VIII for more complete discussion of both rail and air service changes.)

Continuation of Rail Freight Services

Recent critical events resulting in the bankruptcy and reorganization of a number of railroads operating in the eastern part of the Nation have stimulated new and increasing attention by State government to the present and future status of continued rail service. In addition, the Railroad Revitalization and Regulatory Reform Act of 1976 requires State involvement in railroad planning and operation as a prerequisite for Federal financial assistance. The U.S. Department of Transportation is actively assisting State transportation agencies in establishing railroad planning programs as integral elements of overall statewide transportation planning. Further, existing railroad facilities are undergoing extensive evaluation in terms of cur-

rent and future traffic levels and the need to maintain or improve capacity in specific routes by the Federal Railroad Administration and by the individual States. The continued examination of railroad facilities in relationship to projections of freight demand has raised the issue of reducing or abandoning railroad service along certain lines which cannot be economically served. A report submitted by the Secretary of Transportation to Congress in February 1974, stated that 25 percent of the trackage in the Northeast carries such a low volume of traffic as to be potentially uneconomic. A more recent study (*Preliminary Standards, Classifications, and Designation of Lines of Class I Railroads in the United States)* by the Department of Transportation has concluded that for the part of the Country outside of the Northeast, there are 25,000 miles of track (approximately 18 percent of existing mileage and 2.4 percent of carload traffic in the area) that are potentially uneconomic by the U.S. Railroad Association planned standard of a line with less than 70 carloads per mile per year. Although the Department of Transportation acknowledges that rail abandonment is warranted in some cases, policymakers should not assume blanket endorsement of abandonment by the Department. Before any decision, the effect of abandonment on the local community must be considered.

This same DOT study did identify a number of transportation alternatives which could be considered as means of providing continued transportation service to those areas where continued unprofitable railroad service was unjustified. State governments in addressing future questions of continued railroad service will require planning and analytic procedures to arrive at solutions that are economically sound, socially responsible, and that effectively deal with possible disruptions to the local economy should sharp reductions in present railroad service ensue.

Financing Future State Transportation Programs

Severe financial problems have beset a number of State transportation agencies as a result of the compounding effects of unprecedented inflation levels in the construction industry and declining revenues from user taxes. These problems have caused many States to consider changing present financing mechanisms for deferred investments and maintenance which have accumulated over the past few years. The changing roles, responsibilities, and priorities of State government in the future have also contributed to the need to reexamine present financing mechanisms. Debate and legislative action have already started in a number of States. Consideration is being given to restructuring State transportation programs and the manner in which they are implemented, as well as to methods for increasing user revenues to account for the increase in the costs of providing transportation. Fuel taxes and other user charges are likely to increase in many States. Several States are considering ad valorem taxes as a way of automatically adjusting future revenues to increases in fuel costs. Also under consideration are a number of alternatives for change in the Federal transportation programs and revenue mechanisms that could have direct consequences upon the level and structure of State transportation programs and revenues. Discussion of several highway finance options can be found in chapter VI.

A current issue of State finance in several States is the increasing costs of highway development and maintenance attendant to the increases in the production and movement of coal and other energy resources. Section 153 of the Federal-Aid Highway Act of 1976 requires the Secretary of Transportation to report to the Congress on the results of a study of "special Federal assistance in the construction or reconstruction of highways on the Federal-aid system necessary for the transportation of coal or other uses in order to promote the solution of the Nation's energy problems." While there will undoubtedly be increases in highway maintenance and construction costs as a result of increased transport of energy resources, the question remains whether such increasing costs require special Federal attention, or if they should be viewed as State and local production costs associated with increased energy development. If viewed in the latter manner, one logical solution is for State and local governments to tax the new energy resources sufficiently to cover the transportation costs associated with their production.

General Aviation

The growth in general aviation activity has been dramatic over the last few decades, although the national economic downturn of the past few years has been reflected in a decline in the annual increase in general aviation during the last few years. There have been increasing arguments offered for altering the administration of the Federal general aviation assistance program so that State governments would assume greater direct responsibility, with, of course, a shift of a Federal revenue source to permit the States to finance the activities. Debate preceding passage of the Airport and Airways Development Act of 1976 included several proposals for decentralizing the general aviation program and placing State government in the predominant administrative role. One section of the 1976 legislation initiated a State demonstration program for the purpose of establishing that participating States are capable of "administering United States grants for general aviation airports in the State." Success in this demonstration program may result in a shift in the administrative responsibility for the general aviation program from the Federal Government to the States, with a shift of a Federal revenue source, and reinforce the need for improved statewide multimodal transportation planning and evaluation capability.

BASIC TRENDS IMPACTING LOCAL TRANSPORTATION

The 25-year period from the end of the Second World War until about 1970 was one of rapid population increase, growth in the economic well-being of the population, and an expressed preference for low-density residential environments and for personal transportation. It was a period during which there was a massive migration of people from rural to urban environments. During this period, there was an enormous investment of public funds in the creation of transportation infrastructure, principally in the highway and air modes. Transportation facilities were built and service was improved to serve the pattern of development.

In this process, many points of high accessibility were created, the accessibility of major activity centers tended to be reinforced, and, on the whole, the productivity of transportation networks both at the local urban and regional levels was improved.

It has been argued that the building of transportation facilities was a principal causal agent for dispersed and low-density patterns of settlement that have developed around American cities. The situation, rather, was typically one in which land development followed a laissez-faire pattern. The construction of transportation facilities, notably highways, typically followed, rather than led, development. The situation was often self-feeding, as improved service to new development served as an impetus for new or more intensive development in some locations.

Along with the movement of population, commercial and industrial activities tended increasingly to concentrate in large metropolitan areas. At the same time, structural change took place in the distribution of such activities within urban environments. Many activities moved out of the central districts of cities, and, relatively, the significance of those central districts as centers of employment has declined. While it can be argued that in urban areas and elsewhere, the public transportation system benefited from the transportation infrastructure that was created in the postwar era—benefited in the sense of having better facilities for use, increased capacities, and increased potential of productivity—there is no question that, particularly in urban areas, the adequacy of public transportation decreased and ridership declined in many instances.

In very recent years, there have been indications that the pattern is changing. The rate of population growth is declining, the average size of households is declining, the rural-to-urban migration seems to be nearing an end—at least some preferences seem to have shifted away from suburban-density living—and so on. Moreover, while the trend toward suburbanization, after 30 years, is still the dominant social and geographic trend in the American lifestyle, no trend in lifestyle as broad in its effects can continue without engendering reaction and countervailing trends. These countertrends are just now becoming discernible although are still of unknown scale. They may, however, become significant, or even dominant by the 1990's.

One of the newly emerged trends that has become evident since 1970 is a perceptible shift in migration toward rural areas. It should be differentiated at the onset from growth on the fringes of urban areas. Rather, reference here is to the growth of free-standing rural communities. Often accompanied by a lifestyle shift, this movement has stopped the long-term decline in population of many of our smaller communities. This new pattern appears to be resulting in population growth rates that are more geographically balanced. In the 1970–74 period, 78 percent of all counties were growing in population, compared to 50 to 55 percent in the 1950–70 period. This shared growth should have a stabilizing effect on the Nation as a whole.

Specific transportation effects will be a function of how populations distribute themselves within the growth areas. If the migrating populations cluster in small communities, then the opportunities for improved transportation services, notably taxi or jitneylike systems, will exist. If however, the tendency is toward continuation of spread rural densities, the dependence on the auto will persist and perhaps exacerbate existing transportation problems.

At the same time, there is evidence of increasing activism in land-use policymaking, which can have far-reaching implications for local transportation. In recent sessions of the Congress, proposed legislation to provide incentives for statewide land development planning has been introduced several times but has not yet been passed. Some areas, for example, Petaluma in Marin County, California, and Suffolk County, New York, have announced policies of severely constrained growth. Many States are considering legislation to protect prime agricultural land from more intensive development. The recent California Coastal Zone Act imposes severe restrictions on development in the defined zone. And the Environmental Protection Agency's requirement for environmental impact statements and public hearings may be viewed as levers for land development control. The current land-use situation may then be characterized as follows:

- The prospect for a more integrated and comprehensive policy approach to land development and land-use control coming into being at the Federal and State levels during the next 4 or 5 years is high.
- A decrease in average family size, the high and rising cost of housing, and changes in population composition are likely to lead to alterations in housing choices. The emerging pattern of development is likely to be different from that which prevailed in the 1950's and 1960's.
- Industrial and commercial growth, plant replacement, and the like seem also to be undergoing centrifugal change. Again, the scale of this trend is unclear.
- The rate at which land is converted to urban uses is likely to change significantly. The higher costs of construction as well as legislation circumscribing severely the conversion of agricultural land may well direct intensive development to those relatively underdeveloped portions of urban areas in which there is an urban infrastructure, for example, sewerlines and waterlines, and where some level of transportation service already exists.

Outlook

The main purposes of local transportation—goods' movement and local travel for business and government purposes; and personal travel (getting to and from work and school, shopping, and attending to personal business and family care, and recreational, religious, and related pursuits)—are likely to continue unchanged for the rest of the century. However, the pattern of origins and destinations for each of these types of trips is changing, particularly in metropolitan areas, and these changes are likely to have a profound influence on future demand for local transportation.

Forecasts

Few changes are expected in the purposes served by local transportation over the rest of the century. However, the travel patterns associated with the purposes are expected to continue to change—caused by shifts in the locations of various human activities. Business and government will continue to depend on transportation's ability to move people and goods expeditiously.

One major trend that is expected to continue is the increasing share of population re-

siding within metropolitan areas relative to small urban and rural areas as shown in figure XI.1. The expansion of territory within the metropolitan areas occurs when an existing metropolitan area expands because of growth at its periphery, and also when small towns grow sufficiently to be classified as metropolitan areas. In percentage terms, the metropolitan population is expected to increase from roughly 72 percent in 1975 to 85 percent in 1990. The corresponding growth in metropolitan land area as a percent of the total U.S. land area is expected to be from 14 percent in 1975 to 21 percent in 1990. The combination of these two trends will likely result in the decrease of population density of metropolitan areas from about 308 persons per square mile in 1975 to 271 persons per square mile in 1990. Other things being equal, decreasing densities imply greater distances between people and, therefore, increasing average trip lengths.

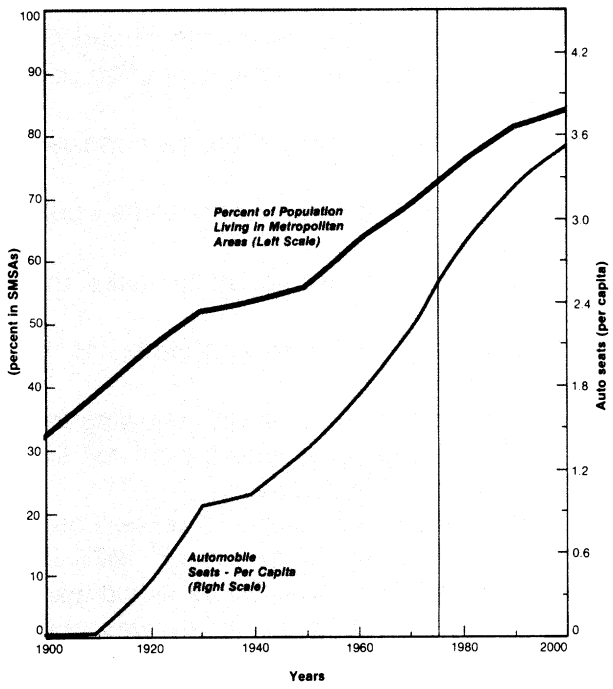


Figure XI.1. Metropolitan Growth and Automobile Usage.

Expenditures for travel on roads and highways overwhelmingly dominate the expenditures for travel by other modes. This pattern is expected to continue. Currently, road and highway expenditures account for about 95 to 99 percent of the total expenditures (depending on definitions used). By 1990, these corresponding figures are expected to be 93 to 97 percent.

Private and business auto travel alone currently accounts for roughly 55 percent of the expenditures, and this figure is expected to increase to 63 percent by 1990. Small pickup trucks and vans used largely for personal travel account for another large and growing percentage of local travel.

The density of local movement in metropolitan areas is now and is expected to continue to be 16 or 17 times the density in small urban and rural areas. This is shown in the following figures which use transportation expenditures per square mile as an indicator of transport activity.

Annual Local Transportation Expenditures Per Square Mile
(Constant 1975 $)

	1975	*1990*	*Increase*
1. Metropolitan	222,775	281,380	26%
2. Small Urban and Rural	13,595	16,590	22%
3. Ratio	16.4	17.0	

This great and increasing concentration of transportation in metropolitan areas partially explains current metropolitan congestion and air pollution problems. Travel densities in both the metropolitan and the small urban and rural areas are expected to increase between 1975 and 1990.

The foregoing estimates are based on a nationwide highway travel demand measured in vehicle-miles of travel growing at an overall annual rate of about 2.2 percent—well below the growth rates of the past decades. The greatest percentage growth rates are expected in small urban areas or cities having current populations between 5,000 and 50,000, where an annual growth rate of about 6 percent is expected. However, such travel accounted for only 5 percent of the total national travel in 1975 and is expected to account for only 9 percent by 1990.

STATE AND LOCAL PLANNING AND PLANS

The Federal Government, through laws, regulations, and procedures associated with its aid

programs, has placed a number of planning requirements on State and local governments. For example:

- The Department of Transportation:

a. Requires States to do State highway planning;

b. Encourages States to address possible rail abandonments, and/or service reductions in State rail plans;

c. Encourages States to develop State airport plans;

d. Requires State highway safety program plans;

e. Requires evidence of continuing comprehensive, coordinated transportation planning at the urbanized area or metropolitan level and requires specific types of plans to be developed as a condition for receiving certain classes of Federal funds.

- The Environmental Protection Agency established clean air standards and air quality control regions. It then required each air quality control region to develop plans for meeting the Federal clean air standards, assuming automotive emission standards are met.
- The Federal Energy Administration is financing the development of State energy conservation plans. One of five major requirements of these plans is planning for increased use of carpools, vanpools, and urban mass transportation.

All these planning requirements converge on the State and local planners.

Building in part on the work of State and local governments, the Department of Transportation has historically compiled and prepared nationwide plans. The Federal Highway Administration has submitted to the Congress a series of highway-needs reports addressing future highway developments. The Federal Aviation Administration has published annually a National Aviation System plan. This plan covers developments proposed for the air traffic control, navigation and flight services it provides, and summarizes its intentions concerning Federal aid to airports. In 1976, the National Highway Traffic Safety Administration submitted to the Congress a Needs Report summarizing the relative effectiveness of a broad range of possible highway safety improvements.

In 1972 and 1974, the Department of Transportation published National Transportation Reports. These were broader in scope than the studies described above. They summarized departmental analyses and the results of surveys of State and local facilities, programs, and plans. They made an effort to place the Federal, State, and local governmental programs in a context with overall national transportation developments. However, these documents focus primarily on the programs that receive substantial State and local financial support. Thus, highways, urban mass transportation, and airports eligible for Federal aid were most comprehensively treated. States, however, also reported on State or locally supported transportation developments in other areas such as terminals, parking areas, port developments, etc. These reports summarized all intended future State and locally funded transportation developments.

In 1974, State and local governments were asked to submit:

- As of 1972, an inventory of:

a. Physical facilities and equipment,

b. Estimates of transportation movements,

c. Selected estimates of transportation performance.

- For 1972 through 1980, a program indicating:

d. How the preceding inventory items would change by 1980,

e. What the costs would be to make the changes, and

f. The sources of funds anticipated to finance the changes.

- For 1972 through 1990, a plan showing the same items as the programs, except for the sources of funds, in less detail.

For this document they were asked if they wanted to voluntarily update their 1972–90 plans. It was felt that some States would want to do so since the original survey was conducted before the petroleum embargo of 1973 and 1974. Fuel price increases since that time both modified travel patterns and decreased fuel tax revenues to finance local transportation developments.

The planned capital investments by State and local governments add up to about 24 percent of the expected 1975–90 total national capital investments in transportation. They cover almost all the capital investments in highways and urban mass transportation, and thus

would be a major determinant of the future of local transportation.

Fifteen States voluntarily updated their 1972 and 1990 plans. The Department of Transportation converted all the costs reported into 1975 dollars. Table XI.1 summarizes by State the capital costs, and table XI.2 summarizes by State the annual costs (maintenance, operations, etc.) for highways and urban mass transportation, which together account for approximately 92 percent of the State-reported 1972–90 capital investment. The other 8 percent is accounted for by expenditures for airports, parking facilities, marine and other terminals, etc. The 1972–90 capital investment reported, including these items, totals roughly $690 billion. Highways account for $554 billion of this, or 80 percent. Urban mass transportation accounts for another $81 billion or 12 percent.

Both the planned highway and urban mass transportation expenditures appear to be greater than one would expect based on projections of historical trends.

Table XI.3 shows highway expenditures for capital and annual costs for the years 1970–74. Capital expenditures have been decreasing since 1971, while expenditures for annual costs were increasing until 1973, and 1974 showed a slight drop. It is reasonable to expect annual costs to continue to increase since all the contributing factors such as miles of facilities, vehicular travel, and operation and maintenance costs are also projected to increase. The aggregate annual costs reported by States in table XI.2, $12.8 billion for 1980 and $16.8 billion for 1990, appear to be consistent with current trends and future expectations.

The State-reported plans indicate a reversal in the recent decreasing trend in capital costs. The average yearly expenditure rates imply an expenditure of about $28 billion in 1980 and $47 billion in 1990, clearly beyond historical rates.

Table XI.4 shows capital and annual cost data for transit for the years 1970–75. Both cost components have been increasing at approximately the same rate. If they were to continue to grow at about the same rate, annual costs would be about $4 billion for 1979 and $6 billion for 1989 and capital costs would grow to about $3 billion per year by 1980 and almost $6 billion by 1990. However, the annual costs reported by the States for 1979 and 1989 are $6 billion and $11 billion respectively, considerably higher than indicated by the trends (50 percent and 83 percent respectively). The capital costs reported by the states represent an average yearly expenditure at almost $4 billion for the 1972-1980 period and $4.5 billion for the 1972-1990 period. These rates imply an expenditure of $5.6 billion in 1980 and $7.0 billion in 1990, slightly above the projection of current trends.

U.S. TERRITORIES, POSSESSIONS, AND COMMONWEALTH

Although the States differ somewhat in their transportation problems, assets, and plans, for purposes of this analysis, they have been discussed as a single group. The uniqueness of the States of Hawaii and Alaska, the territories of Guam and American Samoa, the Virgin Islands, and the Commonwealth of Puerto Rico, however, warrant individual discussions, which follow.

Transportation planning for Alaska is unique for several reasons. The massive land distribution program in progress and the potential natural resource and economic development require that land use planning, development planning, and transportation planning be well coordinated. In addition, Alaska has many special features that constrain the growth of transportation systems. The essence of the problem is finding the balance between the interest in developing the resources of Alaska and the necessity of preserving the environmental quality of the State. The Department of Transportation, in recognition of this challenge, has created an Alaskan Transportation Task Force that involves all elements of the Department at the headquarters level. The Department is working closely with the State and other agencies to form a Federal-State Transportation Planning Organization to coordinate transportation planning with other developments and interests.

Transportation Planning for Alaska must consider the special requirements for the three distinct elements of interstate, intrastate, and resource development planning.

The location of Hawaii in the middle of the Pacific places it in a prominent role in interna-

Table XI.1
Capital Costs by State and Mode, 1976 Updated
(Millions of 1975 dollars)

	Time Period	Highways: Urban	Highways: Small Urban Aggregate	Highways: Rural	Highways: Total	Row Percent	Urban Public Trans.	Row Percent	Airports	Row Percent	CBD Parking	Row Percent	Marine Terminals	Row Percent	Other Intercity Terminals	Row Percent	Other Systems	Row Percent	Total Cap. Costs	Row Percent
National TOTALS	72-80	82,089.0	13,481.6	74,299.3	169,869.9	76	30,797.89?	14	12,225.13?	5	3,180.84?	1	4,415.82?	2	774.04?	0	1,189.03?	1	222,462.1?	?
	72-90	251,693.6	47,407.9	256,874.7	555,976.2	80	81,895.56	12	32,439.39?	5	7,436.73?	1	7,505.93?	1	1,851.82?	0	3,722.00?	1	690,827.6	?
Alabama	72-80	904.0	218.6	1,189.5	2,312.1	81	11.35?	0	96.49	3	39.95	1	92.75	3	18.26	1	282.15	10	2,853.0?	?
	72-90	2,146.3	934.6	3,323.0	6,403.9	85	15.35?	0	134.18	2	45.77	1	252.46	3	20.61	0	693.42	9	7,565.7?	?
Alaska	72-80	189.6	144.9	1,472.4	1,806.9	75	9.85	0	460.49?	19	27.47	1	20.16	1	65.01	3	11.36	0	2,401.4?	?
	72-90	736.3	576.0	4,375.8	5,688.1	87	23.82?	0	619.58?	9	25.21	0	24.23	0	147.89	2	7.26	0	6,535.9?	?
Arizona	72-80	820.8	84.5	890.8	1,796.1	87	101.18	5	174.75?	8	.00	0	.00	0	.00	0	.00	0	2,072.0?	?
	72-90	5,614.6	355.0	3,990.3	9,959.9	91	629.89	6	338.43?	3	.00	0	.00	0	.00	0	.00	0	10,928.2?	?
Arkansas'	72-80	416.1	147.7	1,021.4	1,585.2	97	12.98	1	30.19	2	.00?	0	8.81	1	.00	0	.01?	0	1,637.2?	?
	72-90	570.9	621.7	2,903.1	4,095.7	95	33.84	1	78.52	2	.00?	0	13.65	0	.00	0	79.75?	2	4,301.4?	?
California'	72-80	6,508.3	599.8	2,340.6	9,448.7	63	3,633.82?	24	1,288.31?	9	113.42?	1	483.38	3	29.16	0	.00	0	14,996.7?	?
	72-90	15,383.6	1,325.0	5,618.1	22,326.7	58	11,843.93?	31	3,506.33	9	268.17	1	806.86?	2	72.50?	0	.00	0	39,824.5?	?
Colorado	72-80	555.1	85.5	1,102.1	1,743.0	66	703.29	27	141.35	5	41.32	2	.00	0	.00	0	14.33	1	2,643.2	100
	72-90	2,557.4	362.4	2,286.8	5,206.6	75	1,227.37	18	360.24	5	96.41	1	.00	0	.00	0	25.77	0	6,916.4?	?
Connecticut	72-80	1,994.1	433.4	617.6	3,045.1	90	256.30	8	60.85	2	.00?	0	3.30	0	11.79	0	18.58	1	3,395.8?	?
	72-90	2,680.3	668.1	770.4	4,118.8	84	556.64	11	158.00	3	.00?	0	9.25	0	13.12	0	21.10?	0	4,876.9?	?
Delaware	72-80	380.4	13.4	213.4	607.2	82	11.77	2	45.62	6	17.08	2	54.49	7	.00	0	.00	0	736.1	100
	72-90	757.7	33.4	528.3	1,319.4	74	289.03	16	66.72	4	32.06	2	67.78	4	.00	0	.00	0	1,775.0	100
Florida	72-80	2,982.5	870.0	1,504.2	5,356.7	83	140.40	2	633.43	10	109.10	2	158.95	2	.00	0	72.06	1	6,470.6	100
	72-90	15,225.4	5,544.9	9,153.7	29,924.0	87	2,895.70	8	864.90	3	266.85	1	198.15	1	.00	0	165.77	0	34,315.4	100
Georgia	72-80	1,148.6	286.8	1,937.2	3,372.6	61	1,694.81	31	316.91	6	58.09	1	53.96	1	.00	0	.00	0	5,496.4	100
	72-90	5,304.6	1,378.0	6,439.0	13,121.6	77	2,119.87	12	1,495.79	9	165.33	1	133.01	1	.00	0	.00	0	17,035.5	100
Hawaii	72-80	546.5	142.9	344.7	1,034.1	68	58.73	4	375.64	25	9.44	1	52.52	3	.00	0	1.00	0	1,531.5	100
	72-90	1,557.1	697.1	1,408.0	3,662.2	71	827.48	16	549.74	11	15.44	0	113.39	2	.00	0	1.50	0	5,169.8	100
Idaho	72-80	17.5	48.0	490.0	555.5	88	2.4?	0	51.54	8	11.52	2	9.33	1	.00	0	2.96	0	633.3	100
	72-90	33.0	142.6	1,370.7	1,546.3	90	49.90	3	78.28	5	12.01	1	25.12	1	.00	0	7.91	0	1,719.5	100
Illinois	72-80	4,718.5	350.2	4,031.8	9,100.5	72	1,940.31	15	1,139.99	9	79.62	1	11.67	0	282.52	2	110.72	1	12,665.3	100
	72-90	20,123.6	1,712.4	16,270.3	38,106.3	78	5,209.79?	11	4,668.35	10	115.36	0	63.22	0	422.90	1	135.89?	0	48,721.8?	?
Indiana'	72-80	1,408.5	271.0	3,667.9	5,347.4	94	93.14?	2	168.94?	3	40.19	1	50.85	1	.00	0	.00	0	5,700.5?	?
	72-90	2,550.8	780.1	8,000.6	11,331.5	92	183.97?	1	617.31	5	74.92	1	80.15	1	.00	0	.00	0	12,287.8?	?
Iowa	72-80	685.9	282.5	2,087.1	3,055.5	95	23.39	1	84.19	3	56.62	2	.00	0	.00	0	.09	0	3,219.8	100
	72-90	3,417.4	1,403.0	9,526.7	14,347.1	97	28.55	0	348.53	2	107.34	1	.00	0	.43	0	.21	0	14,832.2	100
Kansas'	72-80	1,076.1	150.6	1,012.3	2,239.0	98	6.63?	0	30.31	1	45	0	.00	0	.00	0	3.54	0	2,279.9?	?
	72-90	2,698.8	719.9	3,284.9	6,703.6	95	46.00	1	336.32	5	1.04	0	.00	0	.00	0	6.34	0	7,093.3	100
Kentucky'	72-80	611.6	206.3	1,993.7	2,811.6	92	35.54?	1	202.95	7	22.15?	1	.00?	0	.00	0	.00	0	3,072.2?	?
	72-90	1,284.1	407.9	3,574.4	5,266.4	80	468.74?	7	833.79	13	42.87?	1	8.17	0	.00	0	.00	0	6,619.9?	?
Louisiana'	72-80	1,232.8	169.3	2,420.4	3,822.5	88	75.75?	2	78.72	2	70.12	2	280.59	6	2.27	0	21.82	1	4,351.8?	?
	72-90	4,509.7	2,158.8	6,341.1	13,009.6	84	257.63	2	488.12	3	263.90	2	1,379.41	9	118.17	1	25.53	0	15,542.4?	?
Maine	72-80	81.9	49.0	527.5	658.4	93	7.07	1	13.82	2	.00	0	20.53	3	.00	0	9.16	1	708.9	100
	72-90	195.6	190.8	1,340.2	1,726.6	93	25.92	1	53.43	3	9.82	1	21.06	1	.00	0	18.31	1	1,855.1	100
Maryland	72-80	2,705.8	156.0	917.2	3,779.0	57	2,288.66	35	69.36	1	15.50	0	423.49	6	.00	0	.00	0	6,576.0	100
	72-90	6,409.8	800.5	2,667.8	9,878.1	58	6,099.23	36	154.10	1	46.04	0	716.58	4	.00	0	.00	0	16,894.0	100
Massachusetts'	72-80	1,870.4	49.6	434.7	2,354.7	64	944.63?	26	282.69?	8	13.29?	0	55.82?	2	29.24	1	.00	0	3,680.4?	?
	72-90	7,948.9	289.5	1,342.2	9,580.6	78	2,218.85	18	317.05?	3	13.29?	0	162.14?	1	.00?	0	.00?	0	12,291.2	?
Michigan'	72-80	3,162.4	282.9	2,116.4	5,561.7		1,421.50		504.44		89.08		.00		.00		2.13		7,578.9	100
	72-90	7,473.8	951.4	5,432.2	13,857.4		4,903.90?		1,094.78		203.24		.00		.00		5.32		20,064.6?	?
Minnesota	72-80	1,493.9	219.5	1,318.2	3,031.6	85	179.44	5	211.94	6	133.42	4	20.07?	1	.00	0	.00	0	3,576.4?	?
	72-90	3,294.9	462.9	4,218.3	7,976.1	82	1,099.67	11	408.64	4	173.30	2	32.47?	0	.00	0	.00	0	9,690.1?	?
Mississippi	72-80	305.3	217.3	1,855.0	2,377.6	97	5.78	0	59.90?	2	14.70	1	2.19	0	.00	0	.00	0	2,460.1?	?
	72-90	774.1	722.9	4,843.9	6,340.9	97	13.25	0	138.02?	2	24.13	0	3.10	0	.00	0	.00	0	6,519.4?	?
Missouri	72-80	1,941.1	121.2	1,992.7	4,055.0	85	76.51	2	371.64	8	70.01	1	.00	0	181.42	4	22.38	0	4,777.0	100
	72-90	7,738.2	1,919.6	13,688.7	23,346.5	83	3,174.66	11	981.49	3	333.79	1	.00?	0	228.85	1	28.59?	0	28,093.8?	?
Montana'	72-80	71.8	134.6	898.7	1,105.1	94	1.85	0	55.76	5	10.63	1	.00	0	.00	0	.00	0	1,173.3	100
	72-90	432.7	440.2	1,970.2	2,843.1	96	7.12	0	103.34	3	19.97	1	.00	0	.00	0	.00	0	2,973.6	100
Nebraska'	72-80	367.3	123.5	900.3	1,391.1	91	18.61	1	88.95?	6	28.03	2	.00	0	.00	0	.00	0	1,526.6?	?
	72-90	714.1	277.5	2,647.7	3,639.3	90	58.46	1	323.20	8	33.00	1	3.32	0	.00	0	.00	0	4,057.3	100
Nevada	72-80	296.4	11.8	210.8	519.0	83	1.08	0	103.65	17	.00	0	.00	0	.00	0	.00	0	623.7	100
	72-90	773.6	47.1	675.8	1,496.5	76	1.69	0	474.21	24	.00	0	.00	0	.00	0	.00	0	1,972.4	100
New Hampshire	72-80	141.3	156.4	340.1	637.8	98	4.16?	1	6.34	1	5.74	1	.00?	0	.00	0	.00?	0	654.0?	?
	72-90	252.5	235.5	822.7	1,310.7	96	4.37?	0	18.42	1	12.28	1	13.42	1	.00	0	.00?	0	1,359.2?	?
New Jersey	72-80	4,046.5	28.4	409.9	4,484.8	64	1,896.99?	27	380.36	5	.00?	0	245.79	3	.00?	0	16.27	0	7,024.2?	?
	72-90	21,260.8	84.8	2,213.1	23,558.7	79	4,851.62?	16	912.70	3	.00?	0	295.02	1	.00?	0	16.27	0	29,634.3?	?
New Mexico	72-80	100.0	135.3	621.8	857.1	92	3.04	0	40.53	4	21.61	2	.00	0	4.57	0	1.04	0	927.8	100
	72-90	313.9	375.3	1,920.0	2,609.2	94	6.91	0	122.14	4	41.35	1	.00	0	6.11	0	2.03	0	2,787.7	100
New York'	72-80	3,010.5	515.2	1,981.8	5,507.5	37	7,265.52	49	1,165.19?	8	89.97	1	387.95	3	130.79?	1	358.70	2	14,095.6?	?
	72-90	24,135.9	2,914.2	27,863.0	54,915.1	74	13,834.19	19	3,991.35?	5	205.46?	0	41.80?	0	294.92?	0	804.15	1	74,087.0?	?
North Carolina	72-80	814.9	355.8	1,785.1	2,955.8	85	112.91	3	230.58?	7	35.80	1	135.41	4	.00	0	4.13	0	3,474.6?	?
	72-90	3,277.8	2,893.0	17,065.0	23,235.8	96	144.28?	1	433.71?	2	203.74	1	156.89	1	.00	0	.36?	0	24,174.8?	?
North Dakota	72-80	28.3	82.0	689.9	800.2	96	1.12	0	25.48	3	5.65	1	.00	0	.00	0	.00	0	832.4	100
	72-90	61.5	177.3	1,984.6	2,223.4	96	1.95	0	71.73	3	11.88	1	.00	0	.00	0	.00	0	2,309.0	100
Ohio	72-80	3,459.1	670.1	778.7	4,907.9	88	223.98	4	326.50	6	87.40	2	.00	0	1.52	0	.00	0	5,547.3	100
	72-90	10,965.1	1,172.8	1,886.8	14,024.7	86	1,247.98	8	695.73	4	206.25	1	48.24	0	3.11?	0	.00	0	16,225.9	?
Oklahoma	72-80	394.0	90.4	667.2	1,151.6	88	7.69?	1	100.19	8	44.85	3	.00	0	.00	0	.00	0	1,304.3?	?
	72-90	942.7	229.2	1,757.9	2,929.8	91	32.06	1	148.34	5	100.92	3	.00	0	.00	0	.00	0	3,211.0	100
Oregon	72-80	630.5	204.1	1,324.8	2,159.4	77	319.64	11	162.36	6	28.03	1	119.57	4	.81	0	18.29	1	2,808.1	100
	72-90	750.1	493.2	2,601.6	3,844.9	70	715.13	13	228.02	4	40.03	1	264.05	5	138.24	3	231.23	4	5,461.6	100
Pennsylvania	72-80	3,510.0	700.5	2,748.9	6,959.4	69	1,959.00?	19	426.02	4	178.70?	2	619.33	6	.00	0	.00	0	10,142.4?	?
	72-90	12,569.9	1,348.1	6,542.5	20,460.5	72	4,699.66?	17	1,249.11	4	424.87?	2	738.55	3	302.13	1	417.68	1	28,292.5?	?
Rhode Island'	72-80	612.4	26.3	46.7	685.4	92	39.59	5	7.88	1	1.27	0	14.18	2	.00	0	.00	0	747.3	100
	72-90	1,623.4	95.1	287.1	2,005.6	95	54.78	3	28.91	1	.29	0	23.11	1	1.70	0	.00	0	2,114.4	100
South Carolina'	72-80	500.6	260.1	729.2	1,489.9	87	34.12	2	61.72	4	.00	0	122.07	7	.00	0	.00	0	1,707.8	100
	72-90	2,040.1	1,265.9	3,063.9	6,369.9	91	58.52	1	330.56	5	.00	0	209.08	3	.00	0	.00	0	6,968.1	100
South Dakota	72-80	15.7	32.7	565.6	613.9	95	.83	0	28.84	4	.00	0	.00	0	.00	0	.00	0	643.5	100
	72-90	83.6	193.1	1,549.6	1,826.3	96	1.59	0	65.36	3	.00	0	.00	0	.00	0	.00	0	1,893.3	100
Tennessee'	72-80	599.5	176.1	1,504.5	2,370.1	95	76.01	3	60.14	2	.00	0	.00	0	.00	0	.00	0	2,506.2	100
	72-90	1,318.0	1,110.4	10,306.1	12,734.5	95	393.29	3	345.29	2	.00	0	.00	0	.13	0	.00	0	13,473.2	100
Texas	72-80	17,585.7	2,525.8	11,387.5	31,499.0	87	1,822.47?	5	1,221.22?	3	1,345.36?	4	242.99	1	.00?	0	.00?	0	36,131.0?	?
	72-90	30,072.0	3,647.3	18,779.3	52,498.6	82	5,388.24?	8	1,949.71?	3	3,357.61?	5	445.92?	1	.00?	0	.00?	0	*63,640.1?	?
Utah	72-80	211.6	36.4	383.9	631.9	88	6.41	1	76.30	11	.00	0	.00	0	.00	0	.00	0	714.7?	?
	72-90	709.2	83.4	1,161.4	1,954.0	88	79.50?	4	185.32	8	.00	0	.00	0	.00	0	.00	0	2,218.8?	?
Vermont	72-80	27.3	83.2	332.1	442.6	98	1.36	0	6.31	1	2.66	1	.00	0	.00	0	.00	0	452.9	100
	72-90	88.9	179.0	723.9	991.8	97	2.23	0	22.35	2	5.32	1	.00	0	.12	0	.00	0	1,021.8?	?
Virginia	72-80	2,807.4	443.2	1,799.7	5,050.3	78	1,036.01	16	97.14	1	60.06	1	238.06	4	.00	0	4.15	0	6,485.7	100
	72-90	7,129.3	1,047.9	3,976.8	12,154.0	81	2,194.19	15	314.19	2	90.27	1	268.81	2	.00	0	.00?	0	15,019.4?	?
Washington'	72-80	2,106.6	451.7	1,316.7	3,875.0	81	209.70	4	148.51	3	79.01	2	339.64	7	2.98	0	112.82	2	4,768.2	100
	72-90	3,284.8	1,483.6	3,716.3	8,484.5	78	788.91	7	394.78	4	125.22	1	652.03	6	15.80	0	419.22	4	10,880.4	100
West Virginia	72-80	656.4	247.6	2,046.1	2,950.1	94	9.81	0	82.23	3	.00?	0	.00	0	.00	0	83.73	3	3,125.8?	?
	72-90	1,025.7	388.3	3,563.1	4,977.1	95	21.33	0	116.35	2	14.94?	0	.00	0	.00	0	83.73	2	5,213.4?	?
Wisconsin	72-80	1,200.4	303.9	2,163.7	3,668.0	91	220.32	5	76.42?	2	13.53	0	38.34	1	14.11	0	9.00	0	4,039.7?	?
	72-90	2,937.3	1,714.7	14,467.5	19,119.5	94	393.50	2	495.38	2	18.77	0	73.73	0	65.31	0	180.23	1	20,346.4	100
Wyoming	72-80	22.9	46.9	528.9	598.7	96	1.65	0	19.30	3	5.58	1	.00	0	.00	0	.00	0	625.2	100
	72-90	107.1	214.1	1,700.2	2,021.4	98	3.95	0	33.87	2	12.52	1	.00	0	.00	0	.00	0	2,071.7	100
Washington, D.C.	72-80	656.3	0.0	0.0	656.3	27	1,508.57	62	227.38	9	49.56	2	.00	0	.00	0	.00	0	2,441.8	100
	72-90	3,031.4	0.0	0.0	3,031.4	58	1,668.39	32	429.87	8	131.93	3	.00	0	.00	0	.00	0	5,261.6	100
Puerto Rico	72-80	458.0	37.2	533.4	1,028.6	66	280.25	18	99.37?	6	55.95	4	96.23	6	.00	0	.00	0	1,560.5?	?
	72-90	805.6	135.7	903.9	1,845.2	51	998.74	28	247.69?	7	43.86	1	145.70	4	.00	0	332.25	9	3,613.4?	?
American Somoa	72-80	0.0	1.6	14.3	15.9	29	.00	0	7.97	14	.00	0	13.41	24	.00	0	8.64?	16	55.4?	?
	72-90	0.0	2.7	23.9	26.6	36	.00	0	17.28	23	.00	0	18.09	24	.00	0	12.16	16	74.1	100
No Response							22		22		25		4		33		38		105	285
							16		15		32		8		39		44		125	296

Based on 1974 National Transportation Study Data — Updated with 1976 data for States marked ¹. A question mark (?) indicates partial data or no data available.

Table XI.2
Total Annual Costs of Highways and Transit by State
(Thousands of 1975 dollars; excludes bond interest)

State	Year	Highways				Total Urban Public Transportation
		Urban	Small Urban Aggregate	Rural	Total	
Alabama	80	19,183	71,341	87,688	118,212	10,183
	90	22,048	11,719	94,513	128,280	12,922
Alaska	80	2,294	1,477	36,310	40,081	5,009
	90	2,860	2,258	49,131	54,249	8,548
Arizona	80	46,019	6,164	148,925	201,108	43,149
	90	86,178	14,818	223,146	324,142	42,846
Arkansas[1]	80	18,760	12,288	145,313	176,311	5,926
	90	21,220	29,336	127,361	177,920	6,512
California[1]	80	784,513	78,415	489,029	1,331,957	853,621
	90	939,543	97,827	510,771	1,547,941	1,186,839
Colorado[1]	80	61,386	11,141	66,966	139,473	28,902
	90	77,467	14,008	82,664	174,139	75,046
Connecticut	80	109,562	21,105	69,015	199,682	76,072
	90	124,963	24,361	77,307	226,821	128,601
Delaware	80	17,390	1,775	14,491	33,656	8,138
	90	20,230	1,985	16,901	59,124	33,246
Florida	80	199,329	43,531	215,366	458,226	67,097
	90	224,608	106,347	258,624	589,079	205,866
Georgia	80	46,572	22,776	112,338	181,686	97,810
	90	49,497	24,339	127,074	200,910	111,806
Hawaii	80	12,508	12,680	31,217	56,405	20,815
	90	16,823	20,473	44,887	82,183	63,286
Idaho	80	4,120	5,436	42,035	51,591	1,195
	90	4,711	5,949	47,550	58,210	3,289
Illinois	80	171,822	28,958	344,446	544,426	492,084
	90	272,268	16,994	232,260	521,522	688,961
Indiana[1]	80	33,189	7,024	90,121	130,334	41,437
	90	41,964	12,203	101,597	156,764	68,287
Iowa	80	38,467	24,998	190,711	254,174	10,318
	90	47,962	29,449	219,511	296,922	13,439
Kansas[1]	80	28,017	18,460	111,522	157,999	6,916
	90	33,503	22,855	104,812	161,170	23,999
Kentucky	80	46,751	21,712	134,548	203,011	22,099
	90	78,890	36,607	225,874	340,971	29,319
Louisiana[1]	80	49,426	27,847	130,591	207,864	56,912
	90	64,873	47,384	141,275	253,532	74,453
Maine	80	10,624	11,126	65,561	87,311	2,663
	90	11,897	12,301	71,180	95,378	6,778
Maryland	80	150,968	19,908	113,880	284,754	139,889
	90	240,384	32,360	189,535	462,279	307,592
Massachusetts[1]	80	296,051	15,507	93,173	404,731	335,239
	90	360,043	18,287	108,089	486,419	562,942
Michigan[1]	80	238,191	34,199	203,889	476,279	162,923
	90	348,905	45,893	254,380	649,178	1,332,501
Minnesota	80	88,551	21,859	200,977	311,387	56,836
	90	117,367	29,631	262,229	409,227	91,236
Mississippi	80	14,663	26,369	120,540	161,572	3,902
	90	20,610	37,066	169,433	227,109	5,631
Missouri	80	70,959	12,907	220,614	304,480	48,285
	90	95,969	18,425	378,700	513,094	155,831
Montana[1]	80	11,099	19,104	63,311	93,514	801
	90	14,567	81,871	104,123	143,561	2,847
Nebraska[1]	80	20,542	9,646	130,165	167,153	7,393
	90	23,987	22,508	364,751	411,246	18,775
Nevada	80	11,542	478	34,684	46,704	2,645
	90	46,822	1,219	48,806	66,847	2,981
New Hampshire	80	12,011	16,355	50,215	78,581	2,055
	90	18,917	21,927	45,142	85,986	2,851
New Jersey	80	296,439	4,035	102,777	403,251	417,927
	90	322,382	4,399	112,048	435,529	698,386
New Mexico	80	6,147	18,094	61,365	85,606	3,719
	90	10,114	24,577	78,630	113,321	4,285
New York[1]	80	669,666	51,729	394,447	1,115,842	1,821,020
	90	776,168	66,270	437,737	1,280,175	3,062,205
North Carolina	80	36,769	33,832	240,727	311,328	25,901
	90	56,334	56,614	357,694	469,642	48,567
North Dakota	80	2,361	6,628	42,822	51,811	823
	90	3,122	9,187	57,151	69,463	1,240
Ohio	80	277,546	32,886	414,920	725,352	162,247
	90	332,693	39,421	497,354	869,468	433,895
Oklahoma	80	15,686	18,969	131,087	165,742	4,079
	90	22,047	22,763	160,801	205,619	6,011
Oregon	80	48,204	22,404	125,241	195,849	61,065
	90	63,828	29,820	166,397	260,045	121,084
Pennsylvania	80	255,659	63,106	513,271	832,042	394,756
	90	305,402	79,168	526,398	910,968	533,276
Rhode Island[1]	80	30,336	1,176	9,142	40,654	14,697
	90	50,535	2,296	14,327	67,158	41,687
South Carolina[1]	80	29,436	21,947	80,911	132,294	37,195
	90	57,233	42,677	157,309	257,219	35,653
South Dakota	80	2,661	6,472	81,723	89,856	1,002
	90	3,804	8,876	12,2715	135,395	1,433
Tennessee[1]	80	52,844	18,998	120,023	191,865	33,976
	90	67,397	24,232	153,090	244,719	78,170
Texas	80	69,941	10,665	173,362	253,968	97,526
	90	144,775	22,081	358,968	525,824	301,961
Utah	80	14,329	3,134	60,448	77,911	4,303
	90	16,090	3,546	70,143	89,779	0
Vermont	80	1,845	5,494	33,608	40,947	827
	90	1,912	5,735	32,582	40,229	1,090
Virginia	80	125,408	30,698	152,063	308,167	96,184
	90	207,937	46,722	237,286	491,945	143,181
Washington[1]	80	72,537	43,087	118,103	233,817	73,862
	90	83,363	60,686	154,842	298,891	150,266
West Virginia	80	6,630	5,154	91,086	102,870	7,703
	90	6,843	5,320	99,478	111,641	10,273
Wisconsin	80	55,991	43,887	204,145	303,973	75,458
	90	69,856	43,857	198,021	311,734	131,183
Wyoming	80	1,280	3,995	31,910	37,155	307
	90	1,659	4,908	40,840	47,407	387
Washington, D.C.	80	36,476	0	0	36,476	52,271
	90	44,322	0	0	44,322	81,787
Puerto Rico	80	47,782	10,539	90,593	148,914	55,689
	90	75,014	32,983	215,349	323,346	148,981
American Samoa	80	0	82	299	381	0
	90	0	80	399	479	0
NATIONAL TOTALS	80	4,750,480	1,000,913	7,035,520	12,786,893	6,082,221
	90	6,120,696	1,419,421	9,292,650	16,832,767	11,281,924
(WITHOUT PUERTO RICO AND AMERICAN SAMOA)	80	4,702,678	990,292	78,944,628	12,637,598	5,996,332
	90	6,045,682	1,386,358	78,721,756	16,166,796	11,132,943

Based on 1974 National Transportation Study Data — Updated with 1976 data for States marked [1]

Table XI.3
Actual National Highway Expenditures by Federal, State, & Local Governments
(Billions of 1975 constant dollars)

Year	Capital Costs	Annual Costs[1]
1970	16.022	10.027
1971	16.347	10.708
1972	15.794	11.222
1973	14.738	11.614
1974	14.244	11.334

[1]*Includes operation, maintenance, administration, and highway patrol.*
Source: Highway Statistics, various years, U.S. Department of Transportation, FHWA.

Table XI.4
Actual National Transit Expenditures
(Billions of 1975 constant dollars)

Year	Capital Costs[1]	Annual Costs[2]
1970	0.649	2.623
1971	0.835	2.711
1972	0.877	2.738
1973	1.601	2.931
1974	1.583	3.386
1975	2.037	3.535

[1]*Unpublished data, Department of Transportation.*
[2]*Transit Fact Book, 1975-1976 Edition, American Public Transit Association, Washington, D.C.*

tional transportation. First, Hawaii is located in a strategic position militarily. Second, it has become an important interim stop for maintenance and refueling of air and water modes involved in the long distance transportation of passengers and freight. Third, its natural amenities have attracted a booming tourist trade. A substantial transportation infrastructure is required to fulfill these roles.

Transportation planning strategies for Hawaii must take into account the unique geography of the State, which comprises eight major islands (one of these, Kahoolawe, is uninhabited; another, Niihau, is privately owned with access restricted to its residents; and another, Lanai, is owned by Dole Pineapple Corp.). The major city, Honolulu, is located on the island of Oahu and is the center of the State's population, commerce, and government. Metropolitan transportation planning strategies are appropriate for the Honolulu metropolitan area only. Elsewhere in the State the appropriate local transportation strategies are those that are applied to mainland rural and small urban areas. Transportation between the various Hawaiian Islands, however, represents a unique challenge to transportation planners for the State of Hawaii.

In view of the expected increases in leisure time, income, and travel for the United States as a whole, coupled with expected population growth in Hawaii, more transportation facilities will have to be constructed or greater efficiencies and utilization of existing facilities will be necessary in the future. Completion of the Oahu Interstate Highway System should facilitate the flow of ground transportation. In addition to the Oahu bus system, which consists of approximately 350 vehicles and maintains a high level of ridership, Hawaii has completed a preliminary engineering study for a proposed 14-mile fixed guideway rail system for the city of Honolulu.

Like Alaska and Hawaii, the U.S. possessions of Guam and Samoa, the territory of the Virgin Islands, and the Commonwealth of Puerto Rico have transportation needs that differ substantially from those on the mainland United States. Furthermore, needs vary significantly among the territories. With the exception of the Commonwealth of Puerto Rico, the territories are all small, densely populated, tropical islands. Puerto Rico differs from the others primarily with respect to size. Contrasts between the territories with respect to composition and terrain have important implications for transportation problems and potential solutions. For example, Guam consists of one island, half of which is plains and half of which is mountains. The Virgin Islands, on the other hand, consist of three islands—one that is big and flat and two that are mountainous. American Samoa consists of four mountainous islands. The high unemployment rate in Puerto Rico is a factor with great significance for transportation.

Table XI.5 presents demographic and land data on the territories. Clearly, the population is relatively young, growing rapidly, and receiving lower incomes than persons on the mainland. The few concentrations of population greater than or equal to 1,000 implies population dispersal, although the compactness of the territories precludes much separation of persons. Overall, the three smallest territories have a combined area less than half the size of an average U.S. county but a combined population three times as high.

Pursuant to Section 29(b) of the Federal-

Table XI.5
Demographic and Land Characteristics

Territory	Population 1970	Percent Population Change 1960-1970	Median Age 1970	Percent Population Under 18 Years in 1970	Per Capita Income 1969[1]	Gross Area Land and Water	Places with Population Over 1,000	Estimated 1990 Population
Puerto Rico	2,712,033	15.4	21.6	43.3	$ 981	3,435	(2)	3,763,000
Guam	84,996	26.8	20.4	45	$2,008	212	8	184,000
Virgin Islands	62,468	94.6	23.0	20	$2,377	133	3	146,433
American Samoa	27,159	35.4	16.1	55	$ 596	76	5	40,000

[1]U.S. per capita income 1969 — $3,139. [2]Puerto Rico had three places with population over 100,000 and four places with population of 50,000 to 100,000 in 1970.
Source: U.S. Census of Population PC(1) 1970.

Aid Highway Act of 1968, the Secretary of Transportation submitted a report to Congress, in April 1970, entitled *Territorial Highway Study: Guam, American Samoa, Virgin Islands*. The primary conclusion of the report was that territorial highway programs would have to be considerably expanded. Transportation problems were attributed to spiraling traffic growth, outmoded improvement practices, and the inability of territory agencies to recruit and retain competent staff members. Accordingly, section 215 concerning territorial highway programs was added to the Federal-Aid Highway Act of 1970. The addition provides for a Federal share of 70 percent for construction and improvement of a system of arterial highways and necessary interisland connectors (e.g., air services and barges).

The viability of nonautomobile solutions to transportation problems may also prove promising, given the high population density and compactness of the territories. For example, Puerto Rico has applied for assistance for a rapid transit system to be constructed incrementally in San Juan and to be coordinated with short-haul jitneys and bus feeder routes. The Virgin Islands are attempting to meet the transportation needs of the elderly and the handicapped through the acquisition of 13 vehicles to be sent to all 3 islands for transporting social agency clients. Additionally, bills are pending before the territorial government of the Virgin Islands to establish a transportation authority with taxing power to subsidize the public transportation operation. The long-range plans for the Virgin Islands include a combination of automobile restrictions and adequate public transit. The establishment of public transportation in Guam would provide needed mobility and the Department of Transportation has expressed interest in participating in the acquisition of capital stock. However, the territorial government of Guam has, for the present time, declined to spend its limited funds on operating assistance. Consequently, with the exception of a small number of taxicabs, there is virtually no public transportation.

In view of the heavy dependence on pedestrianism in many parts of the territories, measures such as construction of curbs and sidewalks and provision of streetlights and other pedestrian amenities are desirable. The development of paths parallel to main roads for pedestrians and bicycles may reduce the problems stemming from the pedestrian-automobile interface. Improvements to paths leading to villages that are inaccessible by road are also needed.

Table XI.6 shows capital and annual cost estimates for the time period 1972-90.

Table XI.6
Total Capital and Annual Costs of Highways
(Millions of adjusted 1975 dollars)

Total Capital Costs
(Millions of Adjusted 1975 Dollars)

Territory	Time Period	Urban	Small Urban Aggregate	Rural	Total	Total Urban Public Transportation
Puerto	72-80	458.0	37.2	533.4	1028.6	280.25
Rico	72-90	805.6	135.7	903.9	1845.2	998.74
American	72-80	0.0	1.6	14.3	15.9	.00
Samoa	72-90	0.0	2,7	23.0	26.6	.00
Guam	72-80					
	72-90	0.0	76.0	91.4	167.4	0.0

Total Annual Costs—Excluding Bond Interest
(Thousands of Adjusted 1975 Dollars)

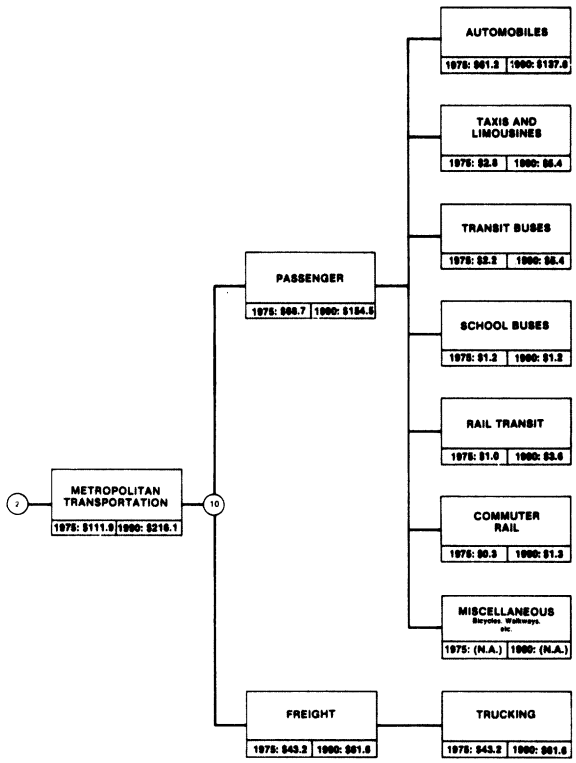
Puerto	80	47,782	10,539	90,593	148,914	55,689
Rico	90	75,014	32,983	215,349	323,346	148,981
American	80	0	82	299	381	0
Samoa	90	0	80	399	479	0
Guam	80	–	–	–	–	–
	90	0	2,592	1,542	4,134	0

Source: Based on 1974 National Transportation Report Data.

CHAPTER XII
Metropolitan Transportation

The metropolitan area is in a sense defined by transportation, because each metropolitan area contains a common commuting area in which the preponderance of jobs are in a central city or its urbanized fringe.

In 1975, there were over 245 SMSA's and SMSA groups known as standard consolidated statistical areas (SCSA's). Figure XII.1 provides a perspective of the relative activity of the modes used in metropolitan transportation.



NOTE: The amounts shown are the transportation bills for 1975 and 1990 in billions of 1975 dollars.

Figure XII.1. Transportation Tree.

A stratification of the SMSA's into size groups is often used to organize individual city data, but size alone throws together such transportation-dissimilar areas as Los Angeles and Chicago. The approach taken in this document is to classify metropolitan areas into four groups—A, B, C, and D—according to their transportation and related characteristics, of which the main ones are relative usage of public transportation, size, and density. Groups A, B, and C, which contain almost all of the large SMSA/SCSA's, have a relative proclivity toward public transportation. All the other metropolitan areas are combined in group D. The SMSA/SCSA composition of groups A, B, and C are shown in table XII.1.

Table XII.1
1975 SMSA Composition of Transportation Area Groups A, B, and C.

Group A ("Big 4")
New York, N.Y. (SCSA)
Chicago, Ill. (SCSA)
Philadelphia, Pa. (SCSA)
Boston, Mass. (SCSA)

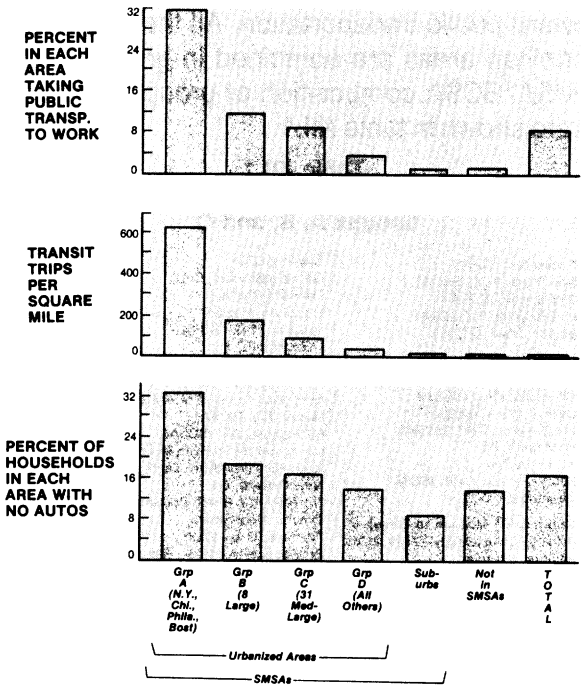
Group B ("Big 8")
Baltimore, Md.
Cleveland, Ohio (SCSA)
Detroit, Mich. (SCSA)
Los Angeles, Calif. (SCSA)
Pittsburgh, Pa.
St. Louis, Mo.
San Francisco, Calif. (SCSA)
Washington, D.C.

Group C (31 Medium to Large)
Albany–Schenectady–Troy, N.Y.
Atlanta, Georgia
Birmingham, Ala.
Buffalo, N.Y.
Cincinnati, Ohio (SCSA)
Columbus, Ohio
Dallas–Fort Worth, Texas
Dayton, Ohio
Denver–Boulder, Colo.
Hartford, Conn.
Honolulu, Hawaii
Houston, Tex. (SCSA)
Indianapolis, Ind.
Kansas City, Mo.–Kan.
Louisville, Ky.–Ind.
Memphis, Tenn.–Ark.–Miss.
Miami, Fla. (SCSA)
Milwaukee, Wis. (SCSA)
Minneapolis–St. Paul, Minn.-Wis.
Nashville–Davidson, Tenn.
New Orleans, La.
Norfolk–Va. Beach-Portsmouth, Va.–N.C.
Omaha, Neb.–Iowa
Portland, Ore.–Wash.
Providence–Warwick–Pawtucket, R.I.–Mass.
Richmond, Va.
Rochester, N.Y.
San Antonio, Texas
San Diego, Calif.
Seattle, Wash. (SCSA)
Syracuse, N.Y.

The four groups of metropolitan areas can be analyzed as such, or they can be made into five groups by using only the urbanized area (UA)[1] portions of groups A to D and lumping the remaining non-urbanized portions of all the SMSA's into a fifth group. The fifth group is called "suburbs" for convenience. The suburb consists of the portion inside the SMSA boundary and outside the UA boundary; it may contain both rural and scattered urban areas. The five-group breakdown provides greater precision for most purposes than the four-group breakdown and is, therefore, used more often in this chapter.

[1]An urbanized area (UA) is a central city over 50,000 in population plus the contiguous urbanized portion of its suburban fringe. The key element in this definition of "urbanized" is that the population density is above 1,000 persons per square mile, i.e., the circumferential boundary extends outward to the perimeter beyond which the population density falls below 1,000 persons per square mile. Thus, the UA boundary is statistically determined and does not correspond to political boundaries. The boundaries are redefined after data are available from each decennial census. Since metropolitan transit services are generally not considered feasible in densities under 1,000 persons per square mile, UA's are the most commonly used areas in local transportation planning.

Figure XII.2 illustrates the strong transit orientation of group A, the older cities whose development largely preceded the automobile. In contrast, the suburbs show very few transit trips and the lowest fraction of nonauto households.



Source: 1970 Census and transit surveys.

Figure XII.2.
1970 Transportation Characteristics of Area Types.

In 1975, the five groups each had about one-fifth of the total metropolitan population (ranging from 18.4 percent for group B to 22.8 percent for group D).

The discussion that follows will explore present and future transportation problems for metropolitan areas, both for the movement of people and of goods.

PERSONAL MOBILITY PROBLEMS

Some problems are inherent in the very concentration of people and activity constituting a metropolitan area. Caesar's Rome had chariot traffic congestion which resulted in the invention of the one-way street. The citizens of ancient Babylon may have complained of the noise and camel droppings from passing caravans. The problems of congestion and pollution are still with us but we are compounding them with changes in the configuration of the cities themselves.

Changing Trip Patterns

By far the most significant change now occurring in the demand for transportation in metropolitan areas is changing trip patterns. By this is meant changes in origins, destinations, or both. A small variation of several blocks or a half mile in the origin or destination of everyone's trips would not make much difference, and is of little interest here. However, large changes on the order of 5 to 10 miles are occurring; these can dramatically alter the demand for transportation facilities and services in a metropolitan area. These changes not only affect the degree and location of traffic densities, they involve directional and trip-length changes which have important independent effects on the most appropriate mode to be used for any given trip.

The underlying cause of these changing trip patterns is the continuing suburbanization of both origins and destinations. The initial suburbanization surge, which occurred early in the century, was largely restricted to residences. It tended to create bedroom communities along the available radial transportation routes extending from the central-city hub. But now the exodus is different. The new throughways enable commuters to move an additional 5 to 40 miles further out. Jobs and shopping facilities are also moving out and they now are being typically served by new suburban beltways. The places of employment in groups A and B are definitely moving toward the suburbs. A complete picture of recent trends will probably not be available until the 1980 census, but comparisons of 1970 census work-trip data indicate that there was a loss of over 1 million jobs in the central cities of groups A and B from 1960 to 1970, a gain of almost 600,000 jobs in group C, while the metropolitan area jobs outside the central cities increased by 6 million in the same time period. The percentages of population in each city-group working outside the central cities in 1960 and 1970 are:

	1960	*1970*
Group A—Big 4	30	47
Group B—Big 8	53	42
Group C—Other 31	37	46
Total, Groups A, B, and C	40	51

Over half of the metropolitan area jobs are now outside the central city and one-third to

one-half are outside the urbanized area in groups A, B, and C. A continuation of present trends will result in three-fourths of the SMSA jobs being located outside the central city by the last decade of the century. The main original reason for the concentration of places of work in the central city was to reduce the time and cost of local travel. Under present conditions, there is little savings to be made in transportation costs by locating in the central city. Furthermore, the suburbs often have lower costs for insurance, taxes, rents, and land.

One of the most significant results of the suburbanization trend is the increase in the length of the home-to-work trip. The percentage of SMSA workers living over 10 miles from work increased from 23 percent in 1963 to 27 percent in the 1969–70 period. The average trip length was about 8–1/2 miles in 1970, but this average is a poor indicator of the energy consumed and pollution generated by the longer trips. The percentage of trip-miles in each mileage class, for SMSA home-to-work trips is as follows:

Miles 1-Way Trip Length	Percent of Total Trip-Miles: All Modes	Private Trans.	Public Trans.
Under 10	31	31	38
10–19	38	38	39
20–100	31	31	23
Total	100	100	100

Thus, those living 20 or more miles from their place of work account for almost a third of the total trip-miles, and those living 10 or more miles away account for over two-thirds.

Shopping-trip origins and destinations are also tending to move toward the suburbs. The 1963 and 1972 censuses of retail trade indicate the following trends in retail sales:

	Percent of SMSA Total (in central business districts) 1963	1972
Group A—Big 4	10	7
Group B—Big 8	7	4
Group C—Other 31	13	6
Total, Groups A, B, and C	10	6

	Percent of SMSA Total (outside central cities) 1963	1972
Group A—Big 4	54	63
Group B—Big 8	63	75
Group C—Other 31	46	57
Total, Groups A, B, and C	54	65

The central business districts (CBD) of the central cities have also suffered absolute decline in total value of sales in this period, after accounting for inflation effects. Even where relatively effective public transportation is available for CBD shopping in offpeak hours, suburban shopping malls are becoming increasingly preferred. Retail sales outside the central cities have grown from about half to about two-thirds of the SMSA total since 1960. The 1963 and 1972 Censuses of Selected Services show a similar pattern for amusement places as trip attractions.

This suburbanization process is mainly one of increasing the square miles rather than increasing the population, and we should expect the data to so indicate.

Figure XII.3 illustrates that, indeed, the suburbanization process has not resulted in any significant shifts in the relative size, in terms of population, among the five groupings of the metropolitan population. The suburban percentage of total SMSA population is increasing only slightly.

The suburbanization story begins to unfold when we look at the land-area expansion relative to population increase. The area and population groupings increased from 1950 to 1975 as follows:

	Percent Increase: Area	Population
All UA's	166	81
Group A—Big 4	166	60
Group B—Big 8	163	81
Group C—Other 31	230	87
Group D	172	35
Suburbs	139	82
All SMSA's	141	81

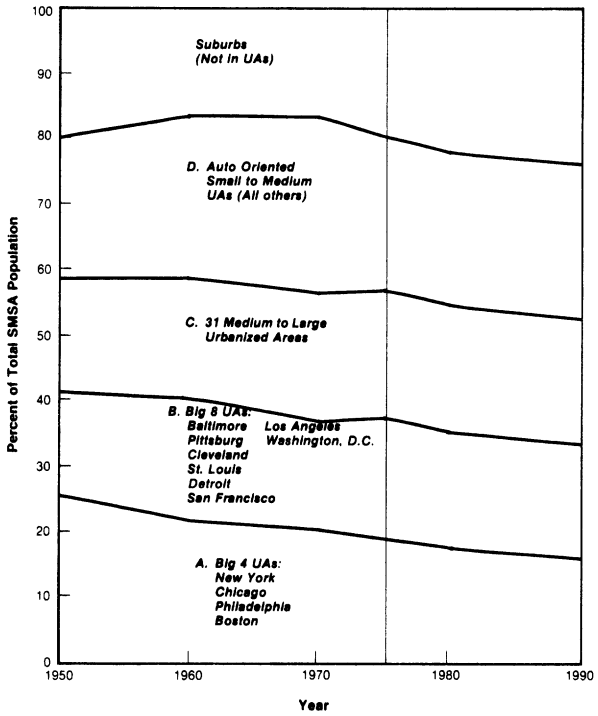


Figure XII.3. Relative Population Trends of Area Types.

In terms of land area, all the urbanized areas expanded by about 24,000 square miles from 1950 to 1975. This expansion is enough land area to contain 80 cities the size of New York or 186 cities the size of Philadelphia. The suburban portions of the SMSA's expanded by about 270,000 square miles from 1950 to 1975, which is more than enough territory to contain both Japan and the United Kingdom.

Since one major criterion for defining SMSA boundaries is commuting patterns, this expansion of SMSA territory reflects the real explosion in commuting distances that has occurred since 1960. Figure XII.4 indicates the additional commuting areas added during the 1960's. The sources of these data are the journey-to-work statistics from the 1960 and 1970 Census of Population.

The suburbanization process impacts future transportation when the combined effect of trends in population and land are measured in terms of population per square mile. Figure XII.5 indicates the dramatic drop in population density occurring in all four urbanized area groups. The "big 4" (New York, Chicago, Philadelphia, and Boston) are maintaining a higher density than the other groups, but their percentage decrease in density from 1950 to 1975 is about average and the drop in absolute terms of about 2,000 persons per square mile (from 7,355 to 5,311) is greater than average.

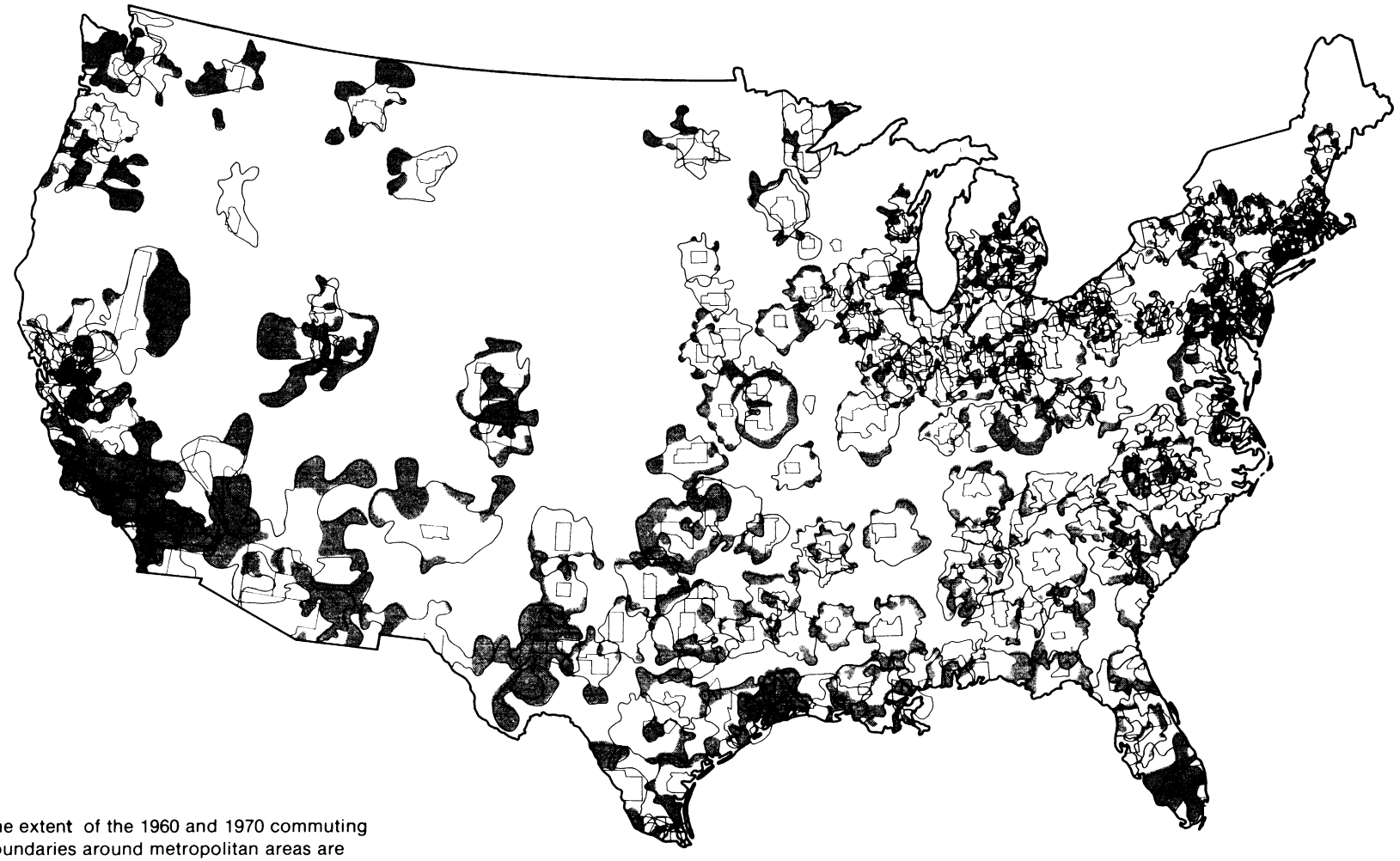
In 1920, there were 12 U.S. cities with a population of half-a-million or more. These constitute our older large cities today. All of them have lost population since 1970, and all but one (Los Angeles) have lost population from 1950 to 1975.

The older large cities are, therefore, directly affecting the suburbanization process.

For all SMSA's in 1970, the population of all the central cities was 3.9 million larger than it was for these same cities in 1960. However, all of this increase was the result of adding territory to the area defined as central city; the 1970 population inside the 1960 city boundaries was the same as it was in 1960. The combined effect of this territorial growth without population growth tends to reduce the density of the central cities. Likewise, the expanding urbanized areas annex adjacent territory to further deflate the average density of the whole urbanized area.

The decrease in average residential density, however, is not necessarily an indicator of a decreasing demand for public transportation. This is because transit utilization is a function of many variables: the size, density, and compactness of the CBD; the number of activity centers and large employment concentrations within the metropolitan area; the quality of the collection and distribution service in the low-density residential neighborhoods; the willingness of people to walk to transit stops and stations; the degree of traffic congestion on the urban highways; the amount and cost of parking available at the nonresidential destinations; etc. In particular, residential density of a suburb is less important for transit use than proximity to a downtown of substantial size. High residential density by itself will do little for transit if there is no dominant place to go.

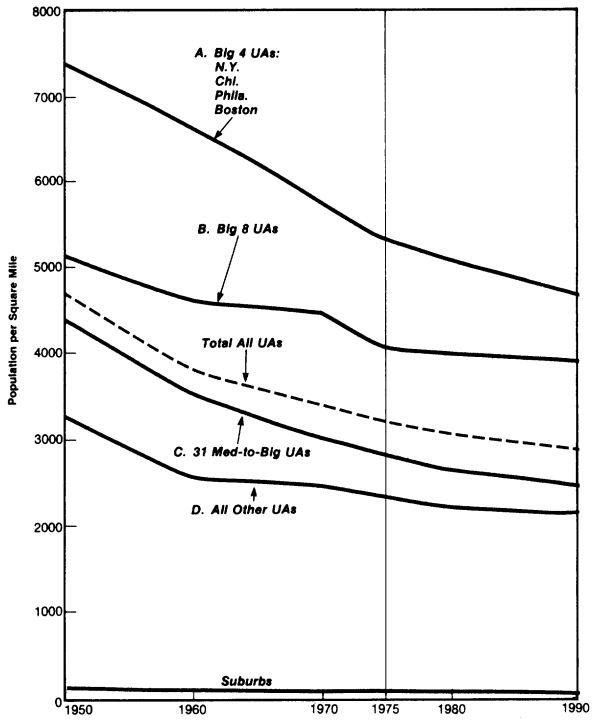
Of course, increasing the density of urban areas in America flies in the face of a long-term trend. The huge investment in spread out development cannot be easily abandoned. The current housing stock cannot be recycled except over a long period of time. Return to older cities is further discouraged by lack of services, lack of amenities, and high tax rates. Land development practices favor construction on



The extent of the 1960 and 1970 commuting boundaries around metropolitan areas are depicted here. The red areas represent the increase in the "Commuter-shed" around these areas from 1960 to 1970.

Source: Dr. B. Berry, Census Statistics.

FIGURE XII.4. 1960—1970 GROWTH IN COMMUTING BOUNDARIES AROUND MAJOR METROPOLITAN AREAS.



Source: Censuses of Population, and projections of trends.

Figure XII.5. Trends in Urban Area Population Density.

vacant land over recycling and redevelopment. Nevertheless, with small households for whom low density is not necessarily an asset, with more white collar and service occupations suited to city environments, with a rising concern for preservation of agricultural land and open spaces, and with renewed interest in and desire for a more urbane way of life a potential for reinforcing high-density areas does exist.

Consideration of future demand includes also the trend in location of nonresidential trip destinations. The urbanized area groups A, B, and C, which contain about 60 percent of the metropolitan population (per fig. XII.3), have maintained an above-average demand for public transportation because of the combined effect of their age, density, and size. The suburbanization of nonresidential trip destinations is most notable in these three groups (A, B, and C). In group D, which consists of the smaller, newer, less dense, and more auto-oriented urbanized areas, suburban conditions can usually be found in the outskirts of the central city, and consequently, there is not as pronounced a trend in this group toward rural suburbs in terms of jobs and stores. In many aspects of future transportation demand, group D is more similar to the suburbs than to groups A, B, and C.

Some of the effects of these trip pattern changes will support automobile transportation. The ubiquitous nature of travel patterns will tend to disperse traffic flows. Heavily congested travel corridors, including those radial routes oriented to commuter travel with heavy peaking characteristics, may gain relief from these trends. On the other hand, the lessening of concentration of demand will work to the disadvantage of traditional transit systems.

The increasingly dispersed nature of travel patterns will require innovative forms of transit service. While conventional rail and bus transit will continue to be the most economical and efficient type of public transportation in heavily congested travel corridors, especially those radial routes oriented to commuter travel, more flexible forms of transit services will have to be implemented to serve suburbs-to-suburbs commuting and other diffuse travel patterns prevailing in the outlying portions of metropolitan areas.

Local transportation planning will have to respond to these changes. Historically, urban planning has been oriented to solving commuting problems, most particularly the suburban-to-downtown commuting trip. However, this element of total travel is decreasing in relative significance. First, in that downtown-oriented commuting is a decreasing percentage of overall work travel. Second, work travel is declining as a percentage of total travel in urban areas. Saturday morning shopping trip and weekend recreation trip congestion, and other flows, are demanding increasing attention.

Reflecting on these trends leads us to recognize the role transportation has played and can play in the future in forming our cities and improving our national quality of life. Effective public policy must recognize the dynamics and the scale of the forces currently affecting the distribution of population in our cities and the role Federal and local policies can play in leading or retarding those forces. Most important of all, the exercise of these policies must proceed from a concrete understanding of our urban goals. Transportation and other urban policies can affect land use patterns for good or ill.

Revitalization of our cities is high on the national agenda of priorities. It must be recognized, as goals are established, that revitalization might take different forms in different cities. Attempts to regain population lost may be inappropriate. Rather, cities should seek to establish only those levels of density that its public services can adequately support, providing an attractive quality of life at reasonable public cost. Declining center city density may be an opportunity to selectively prune inadequate housing and create new public spaces. Revitalization in this sense can mean opening the city once again to sun and air and making it an attractive place to be. Actively supported trends in urban homesteading and restoration of sound housing can provide a viable and attractive in-town alternative to suburban lifestyles.

Transportation has made significant contribution to the quality of life in our cities. It has also been the cause of serious reduction in life quality in many cases. The capacity of transportation to contribute to the enhanced quality of life in our cities and towns is real and direct. To use it effectively as a tool for that purpose, our citizens and public leaders must acquire a greater sense of what they want their cities to become, and must gain greater understanding of the role mobility plays in the process of forming their cities and lifestyles.

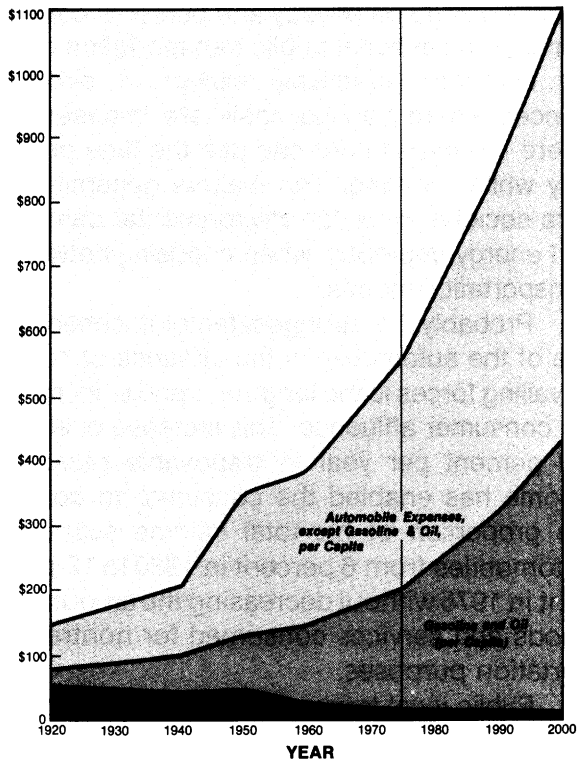
Modal Choice Trends

The changing trip patterns described in the preceding subsection will tend to increase the relative demand for private motor vehicles over public transportation for local trips in the absence of countervailing forces. The decreases in density and increases in trip length resulting from the continuation of such trends would tend to place current public transportation systems at a disadvantage in regard to costs and service. Another factor contributing to auto use is that a large part of its fixed costs can be allocated in the mind of the user to overall convenience rather than to any specific trip. The cost factors in a typical modal choice decision (e.g., whether to leave the car in the driveway and spend 70 cents for bus fare out of pocket or to drive and spend 70 cents for gasoline) are usually limited to the variable costs involved in the judgment. When a high value is placed on privacy and personal convenience, conventional public transportation cannot compete effectively except in circumstances where parking costs are imposed or where the transit rider can use the time profitably while traveling. Trip makers generally ignore societal costs for environmental damage and energy depletion when choosing between transportation modes.

Probably the strongest factor in continued use of the automobile in the absence of countervailing forces is the long-run trend of increasing consumer affluence. This increase of about 1.9 percent per year in disposable personal income has enabled the consumer to double the proportion of his total income spent on automobiles from 6 percent in 1930 to 12 percent in 1975 without decreasing the amount of goods and services consumed for nontransportation purposes.

Public local transportation has historically been a small item in the average national consumer's budget. The long-run trend in the total percentage for transit (including commuter rail) and taxi has decreased from 1.6 percent in 1920 to 0.3 percent in 1975. Figure XII.6 provides an extrapolation of the components of these trends. At constant 1975 prices, the expenditures per capita for automobile use increased from $103 in 1920 to $544 in 1975, and would be about twice as large by the end of the century. If public transportation is to play an increasing role in future local travel, a conscious public policy choice will have to be made to dramatically change the relative attractiveness of the service characteristics of private and public transportation.

The relative importance of public transportation among problem conditions in SMSA communities in 1973 is shown in table XII.2. In the central cities, inadequate public transportation ranked with or below street noise, heavy traffic, crime, and litter as undesirable existing conditions. Outside the central cities, inadequate public transportation ranked second behind noise as an undesirable condition. For SMSA's as a whole, 31 percent of the households in 1973 expressed dissatisfaction with the quality of the present public transportation service.



Source: Commerce Department, and projection of trends.

Figure XII.6. Trends in Consumer Expenditures for Automobile, Transit, and Taxi.

Table XII.2
Percentage of SMSA Households Reporting Undesirable Community Conditions, 1973

Neighborhood or Street Condition	Inside Central Cities: Percent Reporting Undesirable or Inadequate Conditions	Inside Central Cities: Percent Wanting to Move Because of Conditions	Outside Central Cities: Percent Reporting Undesirable or Inadequate Conditions	Outside Central Cities: Percent Wanting to Move Because of Conditions
Noise	51		48	
Heavy Traffic	35		27	
Odors	14		11	
Litter	18		10	
Abandoned Buildings	8		4	
Deteriorating Housing	12	5	7	3
Commercial or Industrial	17		12	
Streets Need Repair	12		13	
Street Lighting	14		25	
Crime	22		12	
Schools	6	2	5	1
Shopping Facilities	12	2	12	1
Public Transportation	18	2	43	2

Source: Annual Housing Survey, 1973, *Department of Housing and Urban Development and the Census Bureau.*

FINANCING URBAN TRANSPORTATION

Current Problems and Inequities

Two problems stand out in current approaches to financing urban transportation: increasing transit operating deficits and underpricing of urban automobile travel. These problems are somewhat interrelated. Transit operating deficits are rising as a result of sharply increasing operating costs and declining revenue. Transit operators have not been able to hold the line against rising operating costs. Some of the factors, such as inflation and rising fuel costs, are beyond their control. However, others, such as rising labor costs and operational inefficiencies, are amenable to some control by operators. As for declining revenue, this has largely been the result of declining patronage, but not entirely. In an attempt to stem the tide of receding ridership, many transit operators—in most cases the municipalities themselves—have frozen or reduced fares. The problem with this approach, however, is that transit users are relatively insensitive to fare reductions and, as a result, ridership continues to decline and so does revenue.

Central to this issue is transit's competitive position with respect to the automobile. Automobile users do not pay the full costs of using their vehicles, particularly in peak travel-hours. Furthermore, auto drivers apparently base their decisions to take the auto, instead of transit, on the immediate out-of-pocket costs rather than the full costs involved. The decision to *own* an auto is usually based on general convenience for a variety of trip purposes, including travel at times and to places not served well by public transportation. Thus, the purchase price of the car may not be perceived as charged against any specific trip type. Since auto installment payments occur regularly with time rather than mileage, the owner of the car may perceive that he gets the most for his money by driving more rather than less per month. The combination of circumstances results in a driver-perceived competitive advantage for the auto in most cases.

In the long run the underpricing of both urban automobile and transit travel requires large subsidies, permits people to live further away from their jobs and exacerbates urban sprawl. The move to the suburbs itself often adds to financing problems by taking the driver out of the tax base of the central city which must supply urban transportation facilities. Actions by the city to increase taxes within its boundaries may hasten the flight to the suburbs.

In recent years, cities have suffered from chronic financial problems. A part of the problem is concerned with the increasing level of services expected from the city, combined with a shrinking tax base from which to raise funds.

The political boundaries of most cities are based on the levels of activity, population, and transportation that existed many years ago. As population grew and as faster transportation allowed even greater commuting distance, the city spilled over into neighboring counties or States. What had once been the city's residential area became a transitional area needing more services and producing less tax revenue. The more affluent who had moved out formed the tax base of the surrounding suburban counties, which in many cases could not be tapped by the city. City efforts to tax the CBD businesses often succeeded in driving them out, too.

In recent years, metropolitan agencies and authorities have been formed that cut across the many jurisdictions that make up a metropolitan area. Where these agencies have had an income source—bridges, airports, tunnels, etc.,—they have tended to thrive and perhaps become too autonomous. Where the metropolitan agencies have had to depend on money contributions from member jurisdictions, they have tended to become less effective and to come apart under stress. Since the Federal tax base cuts across local jurisdiction lines, Federal revenue sharing, returning to the metropolitan agencies some of the tax money taken from the metropolitan area, will play an increasingly important role in metropolitan area transportation financing.

Metropolitan area transportation financial problems can be seen to be intimately related with growth and with changing trip patterns. Each metropolitan area has a unique set of problems depending on its geography, its size, its institutions, its history, and its desired future. The solutions to these unique problems are best determined at the local level. For this planning analysis, however, we can summarize the types of problems, and then proceed to examine applicable solutions for the different urban area groups. Problem types include:

- Insufficient service or capacity, either because of traffic growth or because of shifts in travel patterns;
- Congestion, as a symptom of insufficient capacity;
- Adverse environmental impacts, most often because of motor vehicle noise or air pollution. Air pollution problems relate strongly to local geography and meteorological conditions. Furthermore, stationary sources as well as transportation modes pollute.
- Inefficient use of resources. Energy is a general resource consideration but land or capital may be the most critical resource for a particular area.
- Inadequate transportation for one or more groups—handicapped, poor, young, elderly, unemployed—both in densely populated center city regions and in suburbs;
- Difficulty in supporting existing public transportation systems or in financing improvements or additions to the system.

APPROACHES TO SOLVING URBAN TRANSPORTATION PROBLEMS

The various types of urban transportation systems can be categorized into five systems, based on time and distance as shown in figure XII.7.

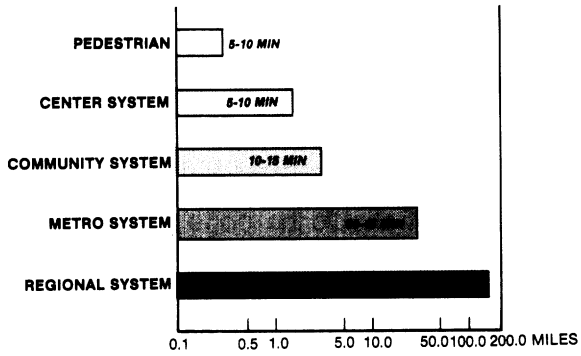


Figure XII.7. Time-Distance Relationships of Urban Transportation Systems.

- *Pedestrian system* — The original mode but in present metropolitan areas often limited to about a quarter of a mile in daylight and fair weather.
- *Center system* — Systems to serve trips in this category effectively are virtually nonexistent now. The trip is one that would be characterized as too long to walk conveniently but somewhat too short to drive, take a taxi or a bus. A large number of trips in the central cities of large metropolitan areas fall into this category.
- *Community system* — The majority of urban travelers to work, school, recreation shopping, etc., use the community system—auto, taxi, bus, transit. This may be the most extensive

system required for many smaller urban areas.

- *Metropolitan system* — Such a system would extend across a large metropolitan area, linking several local community centers and the main city center but with frequent access to serve residential areas en route.
- *Regional system* — Such a system would link several nearby urban areas with limited en route access. The trip differs from one usually termed "intercity" in that it would take place within a "cluster" of urban areas and be made frequently by many people in the course of normal daily activity. The trip might technically be interstate or even international, since such clusters of activity-linked cities do not respect political boundaries.

Two trip types that are not strictly intraurban but that need to be included in urban transportation planning are trips to access long-distance systems — airports most frequently—and trips to outlying recreation areas. The facilities for recreational travel pose special problems since the end point location is often dictated by a unique natural feature rather than transportation convenience and the usage may be heavy but strongly peaked and seasonal.

Given the types of urban transportation problems, what should be done about them? What can be done and what is being done? First, public transportation service must be improved. This will require a market-oriented strategy to identify the markets for public transportation, to determine the type(s) of service that they require, and to provide that service in a cost-effective manner. Some markets will require additional or new services of a more demand-responsive nature to supplement, and in some instances supplant, conventional mass transportation services. In the provision of such tailored services, it is likely that for higher income persons, fares can be set to reflect the true cost more closely. To implement such a market-oriented strategy, transit operators will have to modernize their management practices and more effectively serve the public. It may require contracts or other arrangments with operators of taxi or other paratransit systems to provide public transportation service during times and for areas which cannot be served by mass transportation in a cost-effective manner.

Second, the imbalance between automobile and transit pricing must be corrected. Automobile travel must be priced to reflect the full cost to society of its use. This is most important for use of automobiles during peak hours in congestion-prone areas and may be accomplished using parking surcharges, supplementary licensing schemes, or more sophisticated peak-hour pricing approaches. The imbalance between automobile and transit prices is not only related to the actual price differences but also to the perceived price differences. Transit riders pay the price of their transit trip in the form of a fare at the time of use, whereas, many of the automobile costs are paid in monthly or yearly payments. Prepayments of transit fares, perhaps with bulk discounts, might reduce the perceived cost of transit trips.

Third, transit financing must be placed on a more solid footing. The proper mix of private (fares) and public (taxes) funds for public transportation will depend on the objectives sought by the particular metropolitan area and the value received. Further, fare cannot be considered separate from service. There is no way to increase both ridership and revenue by making only fare changes. To increase ridership *and* revenue will require fare-service packages which meet travel requirements for particular market segments of the travel public. Those persons who are unable to afford higher fares should receive subsidies directly, and the cost should be borne by the welfare agencies, school agencies, or the general fund. Transit systems should not have to subsidize these disadvantaged travelers; on the other hand, transit systems fares for the affluent should not be limited to what the disadvantaged can pay.

The transit operating deficit would be reduced by pricing transit closer to cost and directly subsidizing transportation-disadvantaged citizens. The remaining deficit should be funded at a level commensurate with the benefits received in terms of reduced air pollution, congestion, energy consumption, etc. Cities with subway systems buy space, in effect, by having major portions of their transportation capacity underground. One additional measure of benefit is the value of real estate which would have been taken off tax rolls if the same capacity were added on the surface.

Subway construction is extremely expensive, not only in direct costs, but in disruption to the economy while the construction is in progress. A major topic of current transportation research and development is the investigation of methods of reducing tunneling costs. Nevertheless, a city may weigh even the present high cost of a subway against the loss of tax base, destruction of buildings, and permanent dislocation of a surface freeway system plus parking facilities and opt for the subway. Without strong external benefits, it is difficult to justify the present costs of subway fixed-rail systems in terms of purely transportation benefits. Only metropolitan areas with dense travel corridors and large activity concentrations are likely to be able to generate ridership sufficient to warrant heavy rail systems. The rationale of matching cost responsiblity to benefits enjoyed should apply in determining which level of government should cover these costs.

Planning for Large Metropolitan Areas

The four group-A metropolitan areas — New York, Chicago, Philadelphia, and Boston — became fully committed to public transportation in the first quarter of the century before the automobile attained its general dominance. Because of their size, they built extensive rapid transit systems, and the railroad also provided relatively good commuting services. They accordingly find themselves in 1976 with valuable rapid transit facilities, a high population density, and a relatively low rate of automobile use for radially oriented commuting trips. The details of how each of these four areas should plan for the future involve local values and choices and are not appropriate for this document. However, these four areas share a few characteristics with each other or with other areas which deserve mention here.

In meeting future demand and future goals, it would seem reasonable for these areas to center their plans on modifying, expanding, and supplementing their existing rapid transit systems. Since this is what they intend to do, this approach is fully endorsed here. Such systems will provide strong service for downtown-oriented trips, and to some extent to trips destined to regional centers as well. Suburban trips in general and circumferential trips in particular are likely to remain auto oriented. Taxis and paratransit systems will play significant roles in providing service to local trips for the autoless. One city in the group has recognized this philosophy by adopting an approach, for the future, of auto support to transit in downtown-oriented travel, and transit support to the auto in suburban travel. This philosophy can be expected to gain favor throughout group A and other cities in the future.

One important problem not solved by existing rapid transit systems is how to move people around in the dense CBD's. The problem trips are mainly those 1/4 mile to 1–1/2 miles in length to or from the rapid transit stations, or the intercity terminals. Such trips may be too long to walk, especially in bad weather, and buses or taxis on the congested streets may not be attractive alternatives in time or cost. A "center system" solution to this problem would not only help these four cities, it could prove valuable for use in any congested part of any urban area and could even serve as a mini-transit system for small compact cities. There is no off-the-shelf solution to the problem, and both institutional and technological barriers must be overcome in the solution. Pilot projects to solve the problem, involving market testing and technological development, should be sponsored or otherwise supported in several areas.

The Department's downtown people mover demonstration program is designed with this objective in mind. The projects are intended to show whether relatively simple automated systems can provide a reliable and economical solution to the local circulation problems in congested central areas. Such systems have proven effective in controlled environments, such as airports. It is now time to test their feasibility and public acceptance in the harsher, more demanding environment of real cities.

The projects will not only provide for the first time information on the technical feasibility and cost effectiveness of automated transit operation, but also will respond to a broader goal of supporting the effective economic functioning of our central cities.

Another technological approach to a center city system could call for utilization of continuous variable speed moving sidewalk systems. They could be either below ground or elevated to avoid taking ground space. There have not

yet been any full-scale demonstrations, but some long moving-belt systems are in use as "people-movers" in airport terminals.

The institutional problems of new center city systems are interesting. New York and Chicago have buildings a quarter of a mile high in which elevator transportation is provided without involving any financial, service, jurisdictional, safety, or technical problems. Similarly, several cities have built systems of pedestrian skywalks using solely private funds. A parallel appears to exist to the implementation of people-mover systems.

The suburban sections of these four large group A areas have problems and conditions more like those of small SMSA groups than those of their own central cities. Bus service in Tulsa is like bus service feeding the rail or transit stations in suburban Long Island or New Jersey. Potential plans and systems for suburban-type transportation are considered next.

Suburbs and Small Metropolitan Areas

Most suburbs and the several hundred small-to-medium SMSA's in group D are almost all auto oriented, and their plans to 1990 should assume that people will continue to prefer automobiles over public transportation. Some significant transportation development may occur before 1990 to alter this picture, but any fostering of such a development should occur in SMSA group B or C rather than D. Most of the small areas lack the size, density, or both to support any significant new physical developments in public transportation. The most beneficial focii for their activities appear to be: (a) improvement of overall transportation systems management of existing facilities; (b) preservation and improvement of the limited transit systems they already have; and (c) removal of the institutional barriers which tend to prevent taxi companies from providing the least costly possible door-to-door service for the elderly, the handicapped, and for anyone else who needs transportation.

A few exceptions to the overall pattern may arise in group D. Some of the faster growing areas in this group may outgrow it and graduate to group C. Also some local conditions may warrant the trial of some special types of transport innovations, particularly such systems as paratransit services, auto-free zones, and other auto controls.

Cities in group D will be among the fastest growing in the Country over the next 15 years. Transportation investments in this period will have a far more formative effect on the ultimate shape of these cities than on older cities. The integration of transport plans with land-use and environmental plans in these smaller cities will be imperative. The citizens will have to face the issue of what they want their city to become and how transportation can support their goals.

Taxi-Based Systems. In the smaller group D areas, taxi-based systems will probably prove the least costly means of satisfying future demand and community goals regarding transportation for the elderly, handicapped, and for others who need an alternative to the automobile. The unit cost of taxi service can be lowered by offering group riding at reduced fares, in addition to regular service. Regulatory impediments to standard taxis, jitneys, and other paratransit options should be removed and large-scale trials of taxi-based systems should be undertaken in group D areas to test consumer acceptance and economic feasibility. The taxi industry provides an effective unsubsidized service, but is fragmented by regulatory constraints which increase costs and impede service. Removal of these constraints could appreciably improve service by this private sector mode. Every effort should be made to keep taxi systems in the private sector, without creating publicly funded duplicative services.

Medium-Sized Metropolitan Areas

The 39 metropolitan areas in groups B and C can go either way—toward more public transportation like group A, or toward less like group D. In almost all of them, hard decisions are yet to be made concerning transportation plans to 1990.

Decisions have already been made to direct about a fourth of these areas toward more public transportation. San Francisco and Cleveland already have rapid transit service in part of their metropolitan areas, and appear to favor improving and supplementing it.

Washington, D.C., will soon have an extensive subway system; Baltimore and Atlanta will have planned rapid transit systems cover-

ing parts of their areas; and other cities, such as Miami, Detroit, and Buffalo, probably will have some fixed guideway transit lines in operation before 1990. Most areas in groups B and C will probably emphasize improved bus service systems such as will be described later in this section.

In spite of commitments to rapid transit, none of these areas in groups B and C has yet developed a system of transit service that can compete with the automobile in its nonurbanized suburbs and in the less dense fringes. They lack the higher population densities and historical commitment to public transportation existing in the group A areas. If the present trends continue most medium-sized metropolitan areas are unlikely to achieve the level of density and type of travel corridors that would suggest rail transit would be cost-effective.

In these communities a comprehensive bus system would likely be the most successful strategy. The intent would be to serve households with automobiles as well as households without them, and to meet the travel demand of suburbanites as well as provide access to the central business district.

Such a future bus system would include, as an integral part, several different levels of service responding to different travel needs. It could offer faster service than the conventional bus, at less cost than the automobile, for a significant portion of the peak-period passenger-miles. The "new" bus system would not necessarily replace the automobile for *every* trip, but rather would provide an attractive alternative for at least some or some part of the longer trips and part of all trips that produce traffic congestion.

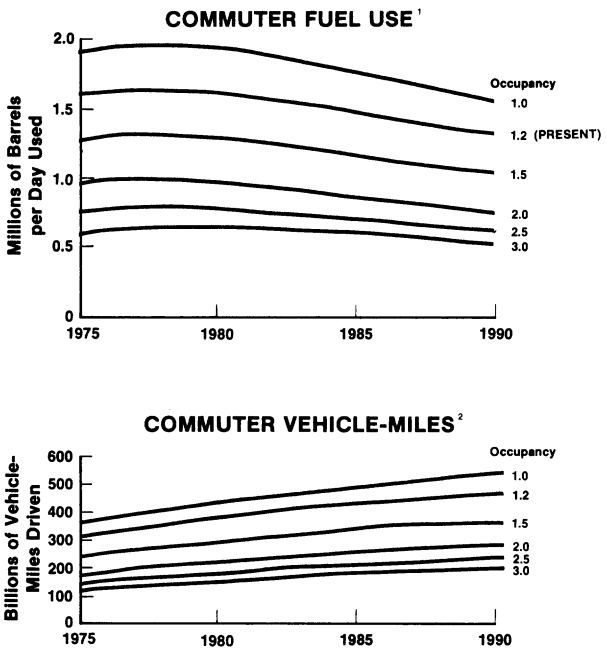
The elements of a comprehensive bus improvement program would be: bus priority over automobiles, especially in peak periods, including reserved or preferential lanes, guideways and ramps, and well-organized terminals. Reliability, comfort, and security would be emphasized along with carefully planned scheduling to minimize transfer times.

Such concepts are, of course, not new. What would be new would be the broad-scale, comprehensive, regionwide implementation of such schemes. Partial efforts cannot be considered a fair test of bus transit's capacity to compete with the automobile.

The test of such an upgraded and modernized bus system could provide much information for local planning and decisionmaking. It would indicate the degree of public acceptance of public transportation which could be expected in the near future in groups B and C with innovative use of existing technology. If public acceptance turns out to be significantly high, all types of metropolitan areas can then give more serious consideration to alternatives to auto-dominated suburbanization.

It is in the group B and C cities also that opportunities for reduction in the number of miles of city streets, particularly in downtown areas, are most significant. Contributing to these opportunities are the following trends: (a) Operating and maintenance costs for streets and highways are skyrocketing and will continue to rise, becoming an increasing burden on local budgets; (b) forecasts of future population and travel are typically inflated for many of these areas, in fact, population decline has been more typical than dramatic increase; (c) innovative transit technologies and transportation systems management approaches such as carpooling and exclusive bus lanes permit greater efficiency on fewer lane-miles of road space; figure XII.8 illustrates the fuel-saving and traffic-reducing potential of commuter carpools; (d) and finally and perhaps most significantly, economic trends in downtown development support this potential. Major projects creating superblocks or small cities, where local governments close old streets and create new pedestrian malls, are burgeoning. Such development trends and creative planning can significantly improve the downtown environment and reduce urban costs. A positive process of pruning unneeded street space, creating auto-restricted zones and pedestrian areas, creating new taxable property, and reducing city maintenance costs can be a major element in revitalizing cities.

Carpooling and vanpooling have potential for reducing the number of vehicle-miles needed to serve the passenger-miles required by the work force. By so doing, benefits are achieved in overall cost, in congestion reduction, in energy consumption, and in pollution emission. The carpool, if it is to work, requires a group of people with similar origins, destinations, and schedules who are compatible



[1]*Potential impact of carpooling on fuel conservation or reduction of emissions and congestion will be a result of reduced vehicular miles of travel in urban commuting. However, these estimates must be tempered by the reality of people's trip patterns and desired times of departure.*
[2]*There is an assumption of continued improvement in auto fuel economy to comply with the EPCA 14.5 urban mpg for the 1980 fleet, 22.3 urban mpg for the 1990 fleet.*

Figure XII.8. Carpool Effectiveness.

enough to be mutually dependent for transportation.

Measures to encourage carpooling must attempt to enhance its benefits, reduce its costs, or increase the costs of not carpooling. All are being tried to some degree. The cost (and inertia) in *forming* a carpool is being reduced by the carpool-matching programs sponsored by DOT and many other organizations. Carpools are given extra parking privileges by many employers and, in a few places, preferential traffic lanes. High fuel costs, parking costs, tolls, etc., generally favor moves *away* from single-occupancy autos. Other measures which can be employed—and are in some cases—are assistance in group purchase of vans for vanpools, changes in insurance regulations and liability for pooled vehicles, and flexible work-hour schedules.

In many ways carpools compete with public transit in that the potential users of each are essentially those who *can* be moved out of their private automobiles. The carpool overcomes public transit's severe empty backhaul problem during peak hours and its inflexible route structure. Public transit, however, may be more attractive to those who dislike the loss of independence in a carpool, to those who cannot match their origin, destination, and schedule with others to form a pool, and for those who have no car and would never drive in a pool. Some measures aimed at encouraging carpools may only succeed in diverting riders from transit. Flexible working hours may favor carpools but staggered hours, which spread the peak load, would favor transit if the spread is large enough for the transit vehicles to make an additional loaded trip.

The carpool can be an excellent emergency tool, since it requires no capital investment and virtually no time or cost to implement. There is some merit to the idea that long-term, nonemergency effort should concentrate on transit and on developing more efficient, less polluting automobiles, while the option of extensive carpooling is kept as an emergency reserve.

PRESENT PLANS, PERFORMANCE AND TRENDS

Over the last 10 years or so, metropolitan planning organizations have progressed substantially in outlining comprehensive plans for improving future transportation. These planning groups possess many of the necessary skills and resources to expedite their metropolitan areas efficiently along whichever path and toward whichever set of goals each SMSA selects.

The most recently published summaries of these plans to the year 1990 are contained in the *1974 National Transportation Report* published in 1975 by the Department of Transportation. Because these summaries did not reflect the consequences of the recession or the fuel shortage, the State planning agencies were given the opportunity in December 1975 to submit to DOT any changes in the State or local transportation plans. Fifteen States submitted revisions in the first part of 1976. In addition, informal surveys of revised transit plans were made by the Urban Mass Transportation Administration and the American Public Transit Association in the last part of 1975. The *1974 National Transportation Report* summarized plans for urbanized areas (that existed in 1970 with the locally forecast 1990 boundaries) rather than for metropolitan areas. These up-

dated plans are summarized next, along with some additional data on the nonurbanized fringes of the metropolitan areas.

Table XII.3 indicates some key supply measures per capita for public and private transportation in the four groups of urbanized areas in 1975, 1980, and 1990. The planned number of public transportation vehicles per 1,000 people in 1990 ranges from less than a third of a vehicle in group D areas to almost one vehicle per 1,000 people in group A areas. A good supply measure for future private transportation is capacity-miles which are determined by multiplying miles of highway lanes by the peak-hour vehicle capacity per lane for each type of highway. The 1990 capacity-miles per capita are planned to range from about 1.1 in group A areas to 1.8 in the less congested group D areas.

Table XII.3
Urbanized Area Summaries of the 1974 National Transportation Study,[1] Part 1

	Category		Year	All U.S. Urbanized Areas	A. Big 4: New York Chicago Philadelphia Boston	B. Big 8: Los Angeles Detroit San Francisco Washington Cleveland St. Louis Pittsburgh Baltimore	C. 31 Other Large to Medium Urbanized Areas	D. All Other Urbanized Areas
PUBLIC TRANSPORTATION	Seat-Miles per Capita	Bus	1975	595	641	738	720	311
			1980	684	627	917	863	380
			1990	678	592	711	1,004	419
		Transit Rail	1975	232	664	201	31	–
			1980	276	662	379	67	–
			1990	376	673	573	291	10
		Commuter Rail	1975	122	440	14	3	1
			1980	129	475	16	6	1
			1990	138	521	16	20	1
		Total Public Transportation	1975	949	1,745	954	754	312
			1980	1,089	1,764	1,312	936	381
			1990	1,192	1,786	1,299	1,315	431
	Public Transportation Vehicles (buses and railcars) per 1,000 people		1975	0.51	0.90	0.48	0.39	0.23
			1980	0.55	0.88	0.61	0.47	0.26
			1990	0.56	0.83	0.61	0.54	0.30
HIGHWAYS	Capacity Miles per Capita	Freeways	1975	.44	.33	.42	.52	.49
			1980	.49	.35	.46	.61	.54
			1990	.59	.49	.54	.69	.65
		Other Highways (and roads)	1975	.93	.61	.91	1.02	1.18
			1980	.92	.63	.87	1.01	1.16
			1990	.92	.66	.80	1.01	1.16
		All Highways	1975	1.37	.94	1.33	1.54	1.67
			1980	1.41	.98	1.33	1.61	1.70
			1990	1.51	1.15	1.34	1.70	1.81
	Vehicle-Miles per Capita	Freeways	1975	1,465	1,222	1,786	1,805	1,121
			1980	1,725	1,388	1,975	2,222	1,397
			1990	2,264	1,955	2,491	2,701	1,937
		Other Highways (and roads)	1975	3,492	2,678	3,521	3,709	4,099
			1980	4,250	3,330	4,251	4,539	4,879
			1990	4,301	3,208	4,684	4,318	4,970
		All Highways	1975	4,958	3,900	5,307	5,514	5,220
			1980	5,975	4,717	6,226	6,761	6,276
			1990	6,565	5,163	7,175	7,019	6,908

[1] *Selected per capita supply plans updated and adjusted in 1976.*

Table XII.4 indicates the expected per capita public expenditures required to finance the total facility purchases planned and the operation and maintenance of the public transportation and highway systems reflected in the preceding table. The capital portion of these costs was not reported on an annual basis but was reported as total costs over two periods of time, from 1975 to 1980 and from 1975 to 1990. These capital costs were converted to an annual basis by two methods identified as "actual" and "annualized" for purposes of summarization and comparison.

Table XII.4
Urbanized Area Summaries of the 1974 National Transportation Study,[1] Part 2

	Category	Year	All U.S. Urbanized Areas	A. Big 4: New York Chicago Philadelphia Boston	B. Big 8: Los Angeles Detroit San Francisco Washington Cleveland St. Louis Pittsburgh Baltimore	C. 31 Other Large to Medium U.A.'s	D. All Other Urbanized Areas
Operation and maintenance costs plus total capital expenditures (1975 dollars) **actual**	Bus	1975	23	35	29	21	10
		1980	32	42	42	32	15
		1990	41	51	48	42	25
	Rail Transit	1975	18	43	20	6	–
		1980	30	63	45	14	–
		1990	42	70	72	28	4
	Commuter Rail	1975	7	24	1	–	–
		1980	10	36	2	–	–
		1990	8	31	3	1	–
	Total Public Transportation	1975	48	102	50	27	10
		1980	72	141	89	46	15
		1990	92	152	123	70	29
	Highways	1975	75	60	72	101	70
		1980	121	98	108	167	114
		1990	159	211	126	138	160
	Total Highways and Public Transportation	1975	123	162	122	128	80
		1980	193	239	197	213	129
		1990	251	363	249	208	189
Operation and maintenance costs plus the 15-year capital expenditure roughly ammortized over a 15 to 40 year period (1975 dollars) **annualized**	Bus	1975	22	33	27	19	9
		1980	29	39	38	28	14
		1990	39	52	48	37	20
	Rail Transit	1975	11	32	7	2	–
		1980	16	41	17	5	–
		1990	27	61	38	13	2
	Commuter Rail	1975	5	17	1	–	–
		1980	6	22	1	–	–
		1990	9	35	2	1	–
	Total Public Transportation	1975	38	82	35	21	9
		1980	51	101	56	33	14
		1990	75	147	88	51	22
	Highways	1975	48	50	50	50	44
		1980	64	65	62	69	59
		1990	75	80	73	77	72

[1]*Per capita costs of public spending for local transportation updated and adjusted in 1976.*

The "actual" costs reflect the latest available actual average data for 1975 and the average annual capital costs based on those planned for the period. Thus, some of the "actual" capital costs reflect some pre-1975 investment decisions and the cost of some projects that will provide their main benefits after 1990.

The "annualized" capital costs were estimated to provide a more realistic basis for comparing the cost of different modes. A percentage of the reported 1975–90 capital costs was assigned to each of the 3 reporting years. Although the annualized costs are only rough estimates, they have the advantage of excluding the bulk of the pre-1975 investment decisions and the bulk of the costs that are more properly charged to post-1990 operations.

Table XII.5 summarizes the preceding two tables in regard to comparing the public transportation and highway plans. Part A of this table shows the percentage change from 1975 to 1990. Group A areas (the big 4), which accounted for about half of the U.S. public transportation seat-miles in 1975, plan for only a 2-percent increase from 1975 to 1990, while group B areas plan a 36-percent increase, group C areas plan a 74-percent increase, and group D areas, a 38-percent increase. For all urbanized areas, public transportation seat-miles have a greater planned 1975–90 increase than highway capacity-miles.

Table XII.5
Urbanized Area Summaries of the 1974 National Transportation Study,[1] Part 3

Category		All U.S. Urbanized Areas	A. Big 4: New York Chicago Philadelphia Boston	B. Big 8: Los Angeles Detroit San Francisco Washington Cleveland St. Louis Pittsburgh Baltimore	C. 31 Other Large to Medium U.A.'s	D. All Other Urbanized Areas
		A. Percent change from 1975 to 1990 in per capita/measures				
Public Transportation	Bus – Seat-Miles	14	-8	-4	39	35
	Transit Rail – Seat-Miles	62	1	185	839	(2)
	Commuter Rail – Seat-Miles	13	18	14	667	(2)
	Total – Seat-Miles	26	2	36	74	38
	Total Vehicles	10	-8	27	38	30
	Actual Total Costs	91	49	146	159	190
	Annualized Total Costs	97	79	151	142	144
Highways	Freeway Capacity-Miles	34	48	29	33	33
	Other Capacity-Miles	-1	8	-12	-1	-2
	Total Capacity-Miles	10	22	1	10	8
	Freeway Vehicle-Miles	55	60	39	50	73
	Other Vehicle-Miles	23	20	33	16	21
	Total – Seat Miles	32	32	35	27	32
	Actual Total Costs	112	252	75	37	129
	Annualized Total Costs	56	60	46	54	64
		B. Public Transportation as a percent of total Highway and Public Transportation				
	Year					
Percent of Total Highway and Public Transportation consisting of Public Transportation	Actual Total Costs (percent of Public Transportation) 1975	38	63	41	21	12
	1980	37	59	45	21	12
	1990	37	42	49	34	15
	Annualized Total Costs (percent of Public Transportation) 1975	44	62	41	30	17
	1980	45	61	47	33	19
	1990	50	65	55	40	23
	Passenger-Miles (percent of Public Transportation) 1975	5	13	4	2	1
	1980	5	13	5	3	1
	1990	5	11	5	3	1

[1]*Updated and adjusted in 1976.* [2]*Insignificant quantities.*

Part B (at bottom of table XII.5) shows public transportation as a percentage of the sum of highway and public transportation. Public transportation is expected to require about half of these total funds in 1990 using the "annualized" costs, and about 37 percent us-

ing the "actual costs." The total annual cost level for urbanized public transportation as reported ranges from about $13 billion to $15 billion in 1990 (at 1975 prices.) This large sum, or the corresponding large percentage of the total, does not, according to the State reported estimates, bring any significant increase in the proportion of public transportation use. The bottom line of the table indicates for 1990 a reported 5-percent share of total miles traveled on public transportation that is the same as the shares reported for 1975 and 1980. This constant share of travel in fact represents a substantial increase in transit activity as overall travel demand grows.

Table XII.6 summarizes some cost and performance data estimates for conventional private and public transportation in urbanized areas. The 12 cents per mile shown for automobiles represents 18 cents per mile based on 1974 average costs increased to 1975 price levels including all purchase, operating, and maintenance costs, divided by an assumed average auto occupancy of 1.5.

Table XII.6
Urbanized Area Summaries of the 1974 National Transportation Study,[1] Part 4

Category		Year	All U.S. Urbanized Areas	A. Big 4: New York Chicago Philadelphia Boston	B. Big 8: Los Angeles Detroit San Francisco Washington Cleveland St. Louis Pittsburgh Baltimore	C. 31 Other Large to Medium U.A.'s	D. All Other Urbanized Areas
Total Cost per Passenger-Mile Cents, 1975 prices (includes OM and Capital Costs)	Automobile (assuming increased mpg offsets increased fuel prices, and 1.5 psngrs per car)	1975					
		1980	12	12	12	12	12
		1990					
	Annualized Public Transportation Costs	1975	12	12	13	11	15
		1980	14	14	15	13	18
		1990	19	21	19	14	20
	Actual Public Transportation Costs	1975	15	14	18	14	16
		1980	20	19	23	18	19
		1990	23	21	26	19	27
Average Speed (mph)	Automobiles (and other private vehicles)	1975	28	25	32	24	30
		1980	28	25	30	28	30
		1990	26	26	34	26	27
	Public Transportation	1975	14	18	15	13	15
		1980	15	18	17	14	14
		1990	19	20	23	19	14
Accessibility — (service per square mile)	Highway Capacity-Miles per Square mile	1975	4,309	4,854	5,532	4,033	3,687
		1980	4,058	4,420	5,081	3,986	3,487
		1990	3,928	4,604	4,660	3,990	3,269
	Public Transportation Seat-miles per Square mile (1,000)	1975	2,979	8,866	4,102	1,970	686
		1980	3,149	8,089	5,086	2,287	778
		1990	3,102	7,122	4,488	3,111	779
Fatalities Per 100 million Passenger-Miles	Highways	1975	2.4	2.6	2.1	1.7	3.2
		1980	2.4	2.8	2.1	1.7	3.2
		1990	2.1	1.8	2.0	1.5	3.0
	Public Transportation	1975	.8	1.0	.3	.8	.2
		1980	.5	.8	.1	.3	.2
		1990	.5	.8	.1	.4	.9
Average age of Public Transportation Vehicles		1975	11	12	10	9	11
		1980	9	11	8	7	7
		1990	9	12	9	7	7
Highway Vehicle-Miles per Capacity-Mile		1975	3,625	4,143	3,978	3,577	3,119
		1980	4,252	4,811	4,697	4,190	3,693
		1990	4,351	4,503	5,359	4,126	3,820

[1] *Comparative costs and performance of public and private transportation updated and adjusted in 1976.*

Table XII.6 does indicate some trends favoring public transportation. The average speed of the automobile is decreasing and the average speed of public transportation is increasing, although auto remains faster on the average. Highway capacity-miles per square mile will remain about the same, but vehicle-miles of travel per capacity-mile are reported increasing, indicating more congestion. This is reflected in the slower highway speeds. The fatality rate will continue to be much lower for public transportation than for the automobile. Also, the goals of energy conservation and reduction of air pollution strongly favor increased use of public transportation.

A comparison of the total cost places the automobile in perspective with transit modes. Using a national average for all urbanized areas, when the traveler's own time en route is valued near the average wage rate—at $5 per hour—then the automobile emerges as the lowest cost mode. Table XII.7 shows the index based on these national averages of the dollar cost for the trip, the time cost, the cost of accidental death and injury, the cost of pollution, and the cost of dependence on imported petroleum, all adjusted to a level of 100 for the auto. The costs are approximations, especially the external factors of safety, pollution, and energy. The corresponding figures for a given location, corridor, or travel situation (e.g., peakhour travel) may vary substantially from the national averages. In particular, mass transportation experiences high load factors in certain corridors and peakhour conditions, thus lowering the costs per passenger-mile. In these conditions, the transit costs per passenger-mile may be significantly less than those of the automobile.

The costs in table XII.7 are dominated by the time cost of the traveler. Where the automobile is significantly faster than bus or rail transit, those modes will remain, on the average, more costly to the user than the auto despite their better performance in safety and emission and energy efficiency. It is important to remember, however, that table XII.7 does use national averages. Where travel times are less than auto travel times the total transit costs are likely to be less than those of the auto. In some places, the ambient air quality may be so precarious that great value can be placed on not adding to pollution; at some times, the value of saving energy may be higher; and in some circumstances, traffic conditions could greatly enhance the relative safety of transit. Finally, some people who must value their time below the average amount will see transit as the best buy; others will encounter urgent circumstances where the most expeditious mode available would be most cost effective.

Table XII.7
1975 Relative Costs per Passenger-Mile of Various Urban and Local Passenger Services

Item	Auto	Taxi	Transit Bus	Heavy Rail[1]	Light Rail[2]	School Bus
Cost	21.6	116.1	45.9	29.7	29.7	10.8
Speed[3]	75.7	75.7	129.8	83.8	121.7	129.8
Safety	1.3	2.3	.03	.04	.02	.4
Emissions[4]	1.1	1.1	.4	.3	.3	.4
Energy[5]	.3	.3	.14	.14	.1	.1
Total	100	195.5	176.3	113.98	151.82	141.5

[1]Heavy rail is defined as subway and elevated rail.
[2]Light rail is defined as trolley service.
[3]The average auto and taxi speed used in the calculations is 18 mph; for transit and school buses 10.4 mph; for heavy rail 16 mph and for light rail 11 mph.
[4]The total damage of all air polluting activities is estimated at $48 billion. A weighted percentage of the tons emitted by mode is used to derive the cost of emissions.
[5]Energy represents the cost of storing the energy by barrel at approximately $1.25 per barrel as discussed in the performance measures section.

Table XII.7 demonstrates that each mode has its own unique pattern of positive and negative attributes. For the future, the safety, emissions, and energy costs of the auto will be reduced, and increasing affluence will raise the value of time. If transit modes are not to lose their market share, then their door-to-door performance must improve. For those times and places where the external cost factors are very high and the automobile user does not normally pay those costs, it is perfectly appropriate to take action to make those costs—or their equivalents—directly perceptible to the traveler. In a central city with chronically poor air quality, the auto-restricted zone is beneficial; in a less dense downtown with favorable meteorological conditions, the auto-restricted zone may be less appropriate.

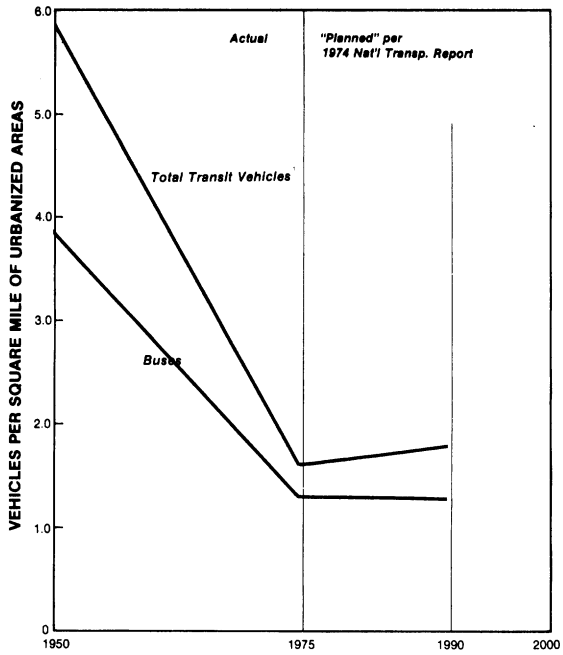
The point to be remembered is this: All of the modes—including some possibly not developed yet—can have their place under some circumstances. The appropriate circumstances and modes depend on the special set of characteristics of each metropolitan area and the particular location in that area. The choices can

best be made by those at the local level most familiar with those circumstances.

The preceding analyses do not include the increasingly popular metropolitan ring beyond the expanding urbanized area boundaries. The reported plans do not reflect intentions to provide any significant amount of public transportation in this ring, but, unless substantial change in public policy occurs, highways will continue to be expanded and upgraded in this ring, so that the ring can be expected to continue its role as a magnet to those in the more congested urbanized areas. The nonurbanized portion of the 1990 metropolitan areas will have about 62 percent of the total metropolitan highway mileage and will require about 37 percent of the total metropolitan highway funds for new and improved highways.

In 1974, the total expenditures for both capital and maintenance highway functions in the United States was $20 billion. Of this total almost half can be identified as being in the 1974 SMSA's. It appears, therefore, that over the next 15 years, State and local highway agencies are planning to increase the portion of their expenditures in SMSA's from about 50 percent to about 75 percent. Most of this increase is due to the expansion of the metropolitan areas and the resulting decrease in land classified as rural. Highway investment in major arterials will be required under present public policy, as these outer fringe areas develop. Unless public policy changes, it is expected that a substantial portion of highway funds will go into developing these facilities.

Finally, it should be noted that the supply plans and trends for transit vehicles do not provide enough capacity to handle more than a small fraction of the total travel demand within urbanized areas. In the nonurbanized portions of SMSA's, transit service is almost nonexistent, and the plans do not indicate present intentions to provide any significant amount of service. In the urbanized areas, the planned number of transit vehicles for 1990 reported in the *1974 National Transportation Report* increases only slightly over the low 1975 number per square mile. These trends are shown in figure XII.9.



[1]*Excludes cars of regular railroads used for commuting.*

Figure XII.9. Trends in Transit Vehicles per Square Mile.

To conclude: (a) The plans for public facilities, services, and trends for metropolitan transportation are adequate to meet the demands of continued suburbanization if improved technology can handle the problems of energy and air pollution. Although the planned expenditures are extensive they do not appear to be keeping pace with the forecast growth in total urban travel. (b) These plans and trends are woefully inadequate for meeting any significant portion of future demands and goals for metropolitan transportation that have the intention of diverting travel from private to public transportation. (c) In the absence of dramatic shifts in attitude, regulatory practices regarding land use or auto use, and upgrading of present transit facilities, there is considerable doubt if there can be a great shift from auto to public transit.

TRANSPORTATION SYSTEM MANAGEMENT

It is becoming increasingly obvious that the concept of making more efficient use of existing transportation resources and facilities must be an essential part of the effort to improve urban mobility. This concept is described as "transportation system management" and is strongly endorsed by the U.S. Department of Transportation.

Urban areas have indicated (in their submissions to the Department's National Transportation Study 1974) that they were planning to give increasing emphasis to low capital and operational types of improvements. The impacts of these types of improvements, however, were not readily apparent in the submitted plans and programs. It is probable that these impacts have not been fully assessed. Urban areas in the United States are only beginning to consider a total management approach to serving travel, including restraints on automobiles, which is gaining wide acceptance in Europe.

Under this concept, automobiles, public transit, taxis, trucks, pedestrians, and bicycles are all considered as elements of one single urban transportation system. The task of transportation system management, or TSM, is to coordinate and harmonize these individual elements through operating, service, and regulatory policies in order to maximize the efficiency and productivity of the system, as a whole. There are four major categories of actions which comprise TSM: (a) actions to insure the efficient use of existing road space, (b) actions to reduce vehicle use in congested areas, (c) actions to improve transit service, and (d) actions to improve internal transit management efficiency. Recognizing that each urban area is unique, with different needs and different problems, these four categories offer an extensive array of strategies from which any urban area—small as well as large—can select the strategy that fits its needs best.

Actions to Insure the Efficient Use of Existing Road Space

This category of actions may represent the single most effective set of measures to improve the efficiency and productivity of the entire urban transportation system. Measures included in this category are the traditional traffic engineering and operations improvements; preferential treatment strategies for transit and other high-occupancy vehicles; provision for pedestrians and bicycles; management and control of parking; changes in work schedules, fare structures, and automobile tolls to adjust the demand for transportation services and facilities.

Traffic Engineering and Operations Improvements. The range of traffic engineering and operation techniques available includes better channelization of traffic, one-way streets, better signalization, progressively timed traffic signals, reversible traffic lanes to adjust to directional flows, ramp metering, and computerized traffic control.

Preferential Treatment for Transit and Other High-Occupancy Vehicles. Increasing the efficiency of existing roadways may be accomplished also by giving preference to high-capacity vehicles. For example, an exclusive bus lane can comfortably accommodate peak-hour volumes of over 25,000 passengers, or over eight times more people than in a normal mixed traffic lane. Reflecting an awareness of this increase in efficiency a number of metropolitan areas across the Country have implemented such programs.

Options include different types of exclusive or preferential lanes on urban freeways and city streets; exclusive freeway access ramps; bus streets; transit preemption of traffic signals; special turning lanes or transit exemption from turning restrictions; and strict enforcement of reserved transit rights-of-way.

Management and Control of Parking Parking policies must address the fundamental question of managing the number of vehicles permitted to park in the central area. One action that encourages people not to drive into the center city is to provide convenient fringe or corridor parking facilities which act as staging points for express transit or ridesharing trips into town.

A major supply of commuter parking space is provided by employers who frequently charge little or nothing. This is essentially a subsidy to their employees who commute by automobile. Recognizing that the existence of assured parking spaces only entices people to drive to work, the emphasis is shifting toward a policy of *restricting* the parking space available.

Walking and Biking. In some cases, improvements in urban mobility do not necessarily involve buses, cars, minibuses, or other vehicles generallv associated with streets and highways. Increasing the opportunity for people to walk or to ride bicycles is a technique that offers benefits in terms of improved urban mobility, improved air quality, and an enhanced urban environment.

The establishment of a pedestrian preference network entails eliminating impediments to walking including: vertical change, vehicle delays, discontinuity of direction, incomprehensible signs, insufficient sidewalk capacity, slippery or rough surfaces, auto fumes and noise, and other threats to safety. Applying urban design principles with respect to widths, heights, distances, and placement and appearance of both functional and visual amenities may promote harmony between the individual and his surroundings. The enjoyment of a walking trip may be enhanced by functional amenities such as benches for resting, shelters for protection from inclement weather and the sun, restrooms, telephones, and trash receptacles. Trees, flowers, plants, sculpture, fountains, art displays, etc., also contribute to the quality of the urban pedestrian experience.

The transit preference network shares many aspects of the pedestrian preference network, because the pedestrian mode is frequently combined with a transit long-haul mode. Therefore, benches, shelters, etc., can benefit both pedestrians and transit users if bus stops are appropriately situated. However, some accommodation to transit in the auto-transit interface is necessary to reduce transit travel time and promote both access to trip destinations and internal circulation.

The construction of bikeways has been accelerating in recent years which may help to reduce the increase in motor vehicle-bicycle accidents. The number of fatalities increased from 570 in 1962 to 1,100 in 1972. Three distinctive types of bikeways are being constructed. Class I designates a facility on a completely separate right-of-way for exclusive use of bicycles. Crossflows by pedestrians and motorists are minimized. Class II facilities are also exclusive, although parking and crossflows by both motorists and pedestrians may be permitted. Class III bikeways consist of a right-of-way shared by bicycles and moving vehicles or pedestrians. Signs on the pavement or on vertical posts by the side of the road indicate that the route is for bicycles. Obviously, Class I bikeways are the most protected from intrusion. Class III bikeways differ from nonbikeways only in that they are chosen because of low-traffic volumes, and drivers are warned of the possible presence of cyclists.

Promotion of bicycling in urban areas resembles promotion of pedestrianism in many respects. Cyclists need continuous, clearly marked, and safe routes over fairly level terrain. Interesting scenery and diversity are desirable. Bicycling can be meshed with pedestrianism and transit. In Washington, D.C., Atlanta, and San Francisco, the rapid rail transit systems are providing lockers where bicycles can be stored safely. A special bus, the "pedal hopper," transports 24 bicycles and their riders at one time from Oakland and Berkeley to San Francisco.

Changes in Work Schedules, Fare Structures, and Automobile Tolls to Adjust the Demand for Services and Facilities. Most city streets experience the greatest demand, and therefore congestion, during peak-period commuting hours.

Some relief from the rush-hour crunch is offered by staggered work-hour programs, which spread employees' arrival and departure times over a longer interval, thus smoothing the difference between peak and nonpeak use of street space and transit vehicles. There are several types of modified work schedules including staggered hours, flexitime, and the compressed or shortened workweek.

Local governments have the option of imposing differential toll charges for bridges, tunnels, and major access roads, varying according to the time of day, to discourage driving into a central area during peakhours. The relative ease of implementing toll charges enhances the attractiveness of this regulatory scheme.

Actions To Reduce Vehicle Use in Congested Areas

Perhaps the most underutilized transportation resource on American streets is the private automobile. Carpooling, vanpooling, and other ridesharing programs can do much to reduce

the number of vehicles on the road by increasing the number of passengers which each vehicle carries. Progress in this area alone can eliminate many of our urban transportation problems at no extra cost to the community and at great personal savings to those participating in shared rides. (See fig. XII.8 on potential shared-ride impacts.) Providing incentives such as preferential parking, flexible working hours, use of company-owned vehicles, use of priority lanes, and commuter-matching services is an attempt to break the American habit of driver-only trips.

A complementary but somewhat different concept for attaining transportation policy objectives is the notion of auto-restricted zones, a multipurpose package for urban redevelopment which promotes integrated land-use and transportation planning. The primary goals of auto-restricted zones are to combat urban congestion, halt air quality deterioration and noise, revitalize city centers, and more equitably distribute public space and investment among users of various modes.

An objective of auto-restricted zones is the enhancement of alternate travel modes via the establishment of pedestrian, bicycle, and transit networks in order to minimize intermodal conflict and reduce traffic in downtown areas. While pedestrian malls or pedestrian/transit malls facilitate internal circulation and safety, detrimental effects may be produced on nearby and adjacent streets unless a comprehensive systemwide approach is taken. For example, if streets in proximity to an auto-restricted zone have insufficient capacity to handle traffic diverted because of the restriction, congestion will be created or exacerbated. Consequently, instead of enhancing the image of the downtown, flexible trip purposes such as shopping may be shifted to other locations. On the other hand, a comprehensive program incorporates efforts to maximize external access through various means including improved transit service, increased capacity on streets surrounding the auto-restricted zone, and establishment of bike paths or exclusive bikelanes coupled with adequate and secure bicycle parking facilities. Because onstreet parking in an auto-restricted zone is usually converted to additional pedestrian walkways or bicycle or transit lanes, parking spaces in the vicinity are at a premium. The parking rate structure should be revised to encourage short-term rather than long-term use.

The concept of auto-restricted zones should not be misconstrued to mean total elimination of vehicular traffic, with the possible exception of public transportation, 24 hours a day. Depending on the rationale for establishing automobile traffic restrictions and the mix of benefits and disbenefits that would presumably accrue from an auto-restricted zone in a particular community, the extent of restriction (total, sector, or parking ban), the type of vehicle restricted (all automotive vehicles or all cars), and the duration of restriction (weekdays, weekends, all day, peak periods, or noon) are determined. Specific implementation measures which are also influenced by a specific situation and include physical, operational, regulatory, and economic measures discussed above in reference to TSM are also applicable to auto-restricted zones.

Given the goal of redistributing public space and investment to achieve a more equitable balance among users of various modes, efforts to diminish auto dominance and to facilitate pedestrianism and the use of transit and bicycles are desirable. The selection of a site for traffic regulation and restriction should follow the assessment of existing conditions. A good location for an auto-restricted zone is an area where pedestrian and transit use are prevalent, e.g., the major downtown shopping street. The removal of impediments to pedestrians and transit users may be expected to encourage greater use and enjoyment of these modes. An area with diverse uses (e.g., offices and shopping) which are separated by traffic may also benefit from auto restrictions or the construction of underpasses, overpasses, or skyways. Restriction of traffic in historic districts and at tourist attractions may not only remove the cause of an inequitable distribution of public space but also an unesthetic intrusion. This program having been implemented in varying degrees, in more than 70 American and 130 European cities, public response has been favorable and the effect on retail sales has been good.

Reducing vehicle use in a more extensive area can be achieved through differential parking surchages, time-of-day user charges, and

area licensing. As mentioned earlier, there are definite hurdles to be overcome in any system of congestion pricing, but the idea is not entirely theoretical. The city of Singapore has introduced a scheme that requires all automobile drivers entering the CBD during the morning rush hour to purchase and display a daily or monthly license in the windshield. The lessons being learned in this project are likely to be helpful to American and European cities which so far have been hesitant to try out such management programs.

The Urban Mass Transportation Administration (UMTA), in cooperation with the Federal Highway Administration (FHWA), is conducting demonstrations of auto-restricted zones in selected cities and also planning demonstrations of congestion pricing.

Actions To Improve Transit Service

The third category of transportation system management actions recognizes the critical role that better transit service plays in any successful program to improve mobility. Preferential treatment schemes and vehicle restriction measures will be relatively much less effective if a quality transit service does not exist to provide people with a realistic alternative to the private automobile. The primary elements in improved transit service are reduced traveltime, more availability, reliability, and frequency of service.

Increasing the frequency of buses and offering express bus service in coordination with local collection and distribution services can attract new ridership by making traveltime by transit more competitive with that of the automobile.

Local collection and distribution functions can be performed by the commuter driving to a convenient fringe or corridor parking area and transferring to an express shuttle service to downtown activity centers. These park-and-ride areas are being made more attractive by providing shelters and other amenities. The feeder service can also be provided by demand-responsive systems such as dial-a-ride which can be booked in advance on a regular subscription basis. Dial-a-ride service has particular applicability to low-density areas, not only for the feeder service, but as local circulation service for the community.

The inherent flexibility of paratransit can be applied in a number of imaginative ways in denser urban environments. Like the driver-only private automobile, the urban taxicab represents another underutilized transportation resource. Taxis could be used much more efficiently as people-movers if local regulations permitted them to act as jitneys.

Today, however, such service can be seen as *complementary*, not only from an energy conservation point of view but also in terms of transit. For example, taxis could be contracted to run jitney operations on regular transit routes at low-demand times (such as early morning, later evening, and on weekends), when ridership does not justify the use of 45-passenger transit service, and at peak commuter hours by traveling heavily used corridors offering a premium public transit service without frequent stops to those willing to pay the extra cost.

Other actions, which can be taken to improve public transit service, relate to better passenger information systems and simplified fare collections methods and policies.

The local fare policy itself must be scrutinized to be sure it reflects the overall transportation objectives. For example, many areas have instituted no-fare or low-fare policies in well-defined, critical areas, such as the CBD, to encourage ridership. Others have applied the practice to a wider area.

Actions To Increase Internal Transit Management Efficiency

The fourth category of transportation system management actions suggests improvements in the internal management of transit operations which can contribute to the efficiency and productivity of the existing resources.

It is essential to transit system reliability that a dedicated maintenance program be conducted. Other internal actions include developing cost accounting, systems analysis, and other management tools to the point where they can be used to improve decisionmaking. Transit operations can also begin to benefit from emerging surveillance and communications technology for real-time monitoring and control capability.

One of the most important and frequently overlooked areas of management responsibil-

ity is marketing. Modern marketing in the transit industry implies a responsiveness to the service needs of current and potential transit patrons and a capability to tailor transit service to meet the public needs in a variety of ways.

METROPOLITAN FREIGHT

Freight movement in metropolitan areas constitutes a major portion of transportation activity, accounting for a significant proportion of total transportation costs, congestion, and adverse impact on the environment. Moreover, indices of metropolitan freight activity suggest that this sector is growing as fast as, or faster than, passenger transport.

Although less than 2 percent of total freight ton-miles were attributed to metropolitan freight movements in 1975, expenditures on this activity accounted for approximately 32 percent of the total transportation bill, or $43.2 billion, compared to intercity freight, which accounted for only 52 percent of the total transportation bill in producing 36 percent of all ton-miles. The local trucking share of the GNP has increased 15 percent in the last 10 years while the intercity share has declined 17 percent.

Metropolitan freight activity cannot be uniformly considered a significant problem in all metropolitan areas (although a more efficient use of resources is always a planning goal). The two forms of freight movement that affect the metropolitan areas are the intercity movement which is routed *through* these areas and the intracity terminal and distribution activity inside the areas.

The amount of through truck travel is not uniformly divided between the metropolitan areas. Although trucks usually try to avoid rush-hour traffic and other congestion, in those areas with a heavy concentration of through traffic, trucks are often responsible for the majority of adverse impacts. Congestion, air and noise pollution, and changing land use may be attributed to metropolitan freight movement.

As cities expanded and changed, many terminals and other freight facilities found their early locations no longer desirable from the standpoint of efficiency. The public also may have found their location objectionable. There has been a trend to consolidate and move these facilities to perimeter areas; this increases the efficiency of the metropolitan freight movement and has a less adverse effect on other urban activities. Therefore, the character and scale of metropolitan freight activity vary greatly among metropolitan areas. The impact of freight movement on a metropolitan area is dependent upon:

- The ability of the physical network to support the traffic, and
- The current land use, including industrial and warehouse locations.

Metropolitan freight movement has been and will continue to be primarily a private sector activity. Where shipping costs influence the prices of commodities or the impact of freight activity on other metropolitan functions is substantial, the involvement of local public officials is warranted. Experience has shown that when the metropolitan goods distribution process is not treated as a system, major inefficiencies are possible.

Background

Metropolitan freight movement includes the transportation of and terminal activities associated with the movement of goods as opposed to the movement of people in metropolitan areas. It includes movement of goods into and out of the area, through the area, as well as within the area by all modes. Such movement includes the transmission of electricity; pipeline movement of petroleum, gas, water, and waste; the collection and movement of trash and mail; service truck movements not identified as personal movements; and those person trips involving substantial movement of goods (e.g., shopping trips).

Although commodities flowing *into* or out of a metropolitan area frequently utilize all modes, the flows typically are concentrated along a few well-defined routes. The arriving commodities usually are transported in large vehicles (or containers) which require special facilities for unloading. Those commodities destined for local consumption (and in some cases for processing before they are transported elsewhere) must be transferred at some point from an intercity to a local carrier.

Metropolitan freight movement is primarily an intracity phenomenon with about three times as many tons loaded onto trucks or into cars during the various steps of goods distribution within the city as are transported into the city by

truck. The data in this section are based on an independent indepth study of the freight movement in 248 urbanized areas and therefore may not be comparable with the National forecasts. Of the total 80 billion miles per year of freight transportation in the 248 largest cities, 70 percent are related to shopping trips and another 27 percent to local truck distribution. This leaves only about 3 percent related to the pickup/delivery and line-haul of a city's freight to and from it by truck.

The total 80 billion miles used for metropolitan freight movement make up about 20 percent of the approximately 393 billion total vehicle-miles in urbanized areas. Of this total, local pickup/delivery trucks make up 14 percent, and over-the-road trucks make up less than 1 percent.

When freight movements are compared to passenger movements in urban areas, a number of similarities stand out: both are sensitive to the level of economic activity within a metropolitan area; both have pronounced peaks during weekdays; both are transported predominantly by motor vehicle (and frequently over the same rights-of-way at the same time); and for both the bulk of travel occurs on weekdays during the daylight hours. However, there are important differences: in contrast to passenger movements, goods movements tend to be more predictable, and susceptible to analysis. They are also more sensitive to seasonal and exogenous economic forces, e.g., Federal monetary policies to stimulate construction. Since goods are inanimate, documentation is essential. Moving goods typically requires more modal interchanges and transfers, and usually a series of one-way flows from origins which are not as dispersed as passenger origins. Goods are much less homogeneous than passengers and require more specialized transportation services, e.g., refrigeration and hazardous-material safety precautions.

Recent statistics reflect the increasing amount of resources devoted to movement of goods within a metropolitan area. Between 1960 and 1970, truck travel in urban areas increased 80 percent as against 74 percent for passenger car travel. Current data indicate that expenditures on local trucking through 1980 will increase at faster annual rates than auto travel and intercity truck transport. Table XII.8 displays the 1990 estimated urban goods movement activity.

Table XII.8
1990 Estimated Urban Good Movement Activity

Category	1973 Activity Level (millions)	1990 Activity Level (millions)	Change (millions)	Percent Change
Tons Picked Up and Delivered	3,079	5,161	2,082	67.6
Pickup and Delivery Stops Made	21,513	35,225	13,712	63.7
Vehicle Miles of Travel	27,705	51,234	23,529	84.9
Cost (1975 dollars)	43,401	80,551	37,151	85.6
Gallons of Fuel Consumed	5,712	10,397	4,685	82.0
Air Emissions (tons)				
Carbon Monoxide	6.28	11.88	5.60	89.1
Hydrocarbons	.77	1.42	.65	84.4
Nitrogen Oxide	.35	.64	.29	82.8

In the next 15 years, metropolitan freight movement should continue to produce major impacts on urban life. Further, these impacts appear to be growing faster than other growth indices. Between 1973 and 1990, the costs of urban freight movement will grow at an annual rate of 3.8 percent in real dollars while fuel consumption will grow at an annual rate of 3.5 percent. This compares with an annual growth rate in tons handled of 3.1 percent and an underlying population growth of only 1.1 percent.

Issues

The current issues in the urban freight sector can be divided into two areas:

- An economic problem of the efficient use of resources including external effects of the present system, and
- A social problem caused by the impact on independent operators (both distributors and retailers) of the current trends of urban goods movement.

The Economic Problem. The current urban freight infrastructure is able to transport the quantity of freight demanded at a cost borne by the consumer. The cost of urban goods movement is reflected in both the selling price of goods and services consumed by the urban community and social cost of the impacts. If urban goods movement is conducted efficiently, these costs are minimized. Since there are inefficiencies created by insufficient technology, incomplete application of existing technology or restrictive institutional constraints,

costs of urban goods movement are elevated above necessary levels. Therefore, the current level of service could be maintained with a reduction in the use of scarce resources (or alternately, more or improved service could be provided at the present consumption rate). The economic problem is twofold:

- The externalities imposed by the urban freight activity on the rest of the community, and
- The inefficiencies in the physical distribution process resulting in higher out-of-pocket costs for goods transported.

Both result in a lower real income for individuals.

The externalities or impacts on urbanized areas are numerous. Six major areas of impact have been identified: congestion, energy consumption, noise and air pollution, inefficient land use, safety, and infrastructure durability. The transportation associated with urban freight movement has a primary impact on each of these areas.

- *Congestion* — The movement of freight, when combined with movement of people over the same streets and highways at the same time, impedes the efficient and timely movement of both.
- *Energy consumption* — Delays and inefficient distribution patterns and techniques result in excess energy consumption in the form of gallons of petroleum wasted.
- *Noise and air pollution* — Incremental emission add to the level of surrounding pollution. Thus, additional pollution added to an already high level of pollution may bring the total to an undesirable level—truck traffic in the CBD at peak hour being a good example. On the other hand, even relatively small amounts of pollution at places and times where the level of pollution is low may become a focal point of attention (e.g., refuse trucks in residential areas during early morning hours).
- *Inefficient land use* — The coincidence of goods and people movement increases the pressure to build additional facilities at the expense of alternative land uses. Land used for shippers and receiver docks and terminals not only cannot be used for other purposes, but affects the use and value of the surrounding land.
- *Safety* — Both the cargo and the vehicle are prone to damage. Accident rates are higher for trucks than for autos during daylight hours; and cargo theft, which ranges from petty thievery to truck hijacking, occurs in virtually all urban areas. Both costs of these incidents are passed on to the individual in the form of higher prices and increase conflict between the movement of people and freight.
- *Infrastructure durability* — There is an increase in pavement wear and structural failure of street and roads, since the design specifications may not have anticipated the heavy loads incurred from the freight traffic.

As freight activity increases within a constant environment of operational and institutional constraints, the negative impact of the system's inefficiencies on transportation costs (and, therefore, on commodity prices), on delays to passengers, and on the environment (particularly noise and air pollution) becomes significant in the economic function of the city.

The major inefficiencies in the operational aspect of the urban freight movement are the following:

- *Delay* — In many cities trucks spend most of the workday immobile as they are stranded in traffic, wait in queues to load or unload, or wait while their drivers search for consignees.
- *Load factors* — The vehicles usually operate well below their capacity, resulting in many trucks doing the work of a few, frequently with empty return trips.

In addition to the inefficiencies cited above, the resulting higher costs contribute to the erosion of the urban economic base.

The Social Issue. The current trend in population distribution toward continued suburbanization has been discussed in the previous sections. Accompanying the suburbanization is a trend of agglomeration both of industries involved in urban freight movement (i.e., food industries, service industries, etc.) and of the retailers involved in urban freight movement (i.e., supermarkets, shopping centers, etc.). As this dispersion of population and, therefore, urban freight movement increases, the distribution service areas also increase. Therefore, ubiquitous distribution ability is required by the large consumers while large distributors find only big shipment sizes profitable for the in-

creased size of the service area. The trend is one of large industries operating on large consumers.

This current trend, shown in table XII.8, of increasing the distance between deliveries (as evidenced in the differing rates of increase for pickup and delivery stops made and vehicle-miles traveled) results most from both the increased agglomeration activity and the general reduction in urban density associated with the migration of manufacturing and wholesale activities from the central city to the urban fringe.

The negative impact of this trend is strongly felt by the small independent operators—both distributors and retailers. The small distributor cannot service the areas required by consolidated stores. The small independent retailer alone bears the cost of the large shipment sizes, since he is not operating in conjunction with other retailers.

The trend toward consolidation also impacts the individual consumers. The total cost to society of urban freight movement includes the automobile shopping trips involved in the movement of goods to the home as well as the commercial costs. Therefore, as the increase in service area continues (shopping centers become more dispersed), the total social cost, which must include not only the reduced costs due to economies of scale of the larger operation but also the increase in transportation costs to the consumer (including social costs of pollution, congestion, etc.) to and from the agglomerated area, may well be increasing rather than decreasing.

Future Alternatives

The Social Problem. The alternatives for solving the social aspect of the urban goods movement problem depend on the direction the local area wishes to take. The local decision-makers considering the benefits and costs of this trend on their local economy must be aware of the total economic and social costs of urban goods movement in their communities. If the benefits are considered substantial, and the trend toward agglomeration encouraged, then the local area must make provisions for the people displaced by the shift, the land-use effects, and increased consumer travel costs. If the costs are considered too high, then two alternate strategies can be pursued:

- Encouraging organization of distributors and experimentation with more efficient distribution processes, and
- Encouraging organization of retailers and experimentation of joint activities so that the deliveries could become economically feasible for the large distributors.

The Economic Problem. There are a number of improvements which can be accomplished in approximately a year or less by better management and administration of the existing transportation system. For example, some cities have arranged for most truck pickups to take place in the morning, and delivery in the afternoons. Certainly, efforts can be made to minimize conflicts with peak-hour traffic. Where rescheduling is successful, driver and vehicle time per consignment is reduced, and there is less congestion from interference with other traffic, less air pollution, energy consumption, and possibly noise per operation. There also may be less accident exposure, since the rate of accidents per million vehicle-miles for trucks in urban areas is greater than for automobiles. The same considerations apply to evening deliveries. Some chain stores prefer to deliver after normal hours. In order for this to be successful, there must be participation from a sufficient number of stores to make it worthwhile. Although one experiment—London's "Operation Moondrop"—demonstrated that this may not always be feasible, the increased costs of daytime deliveries as a result of queues and delays will make this alternative more attractive, particularly if secure "key rooms" or containers are available for drivers to leave the consignments.

Other alternatives which may be implemented in a year or less include:

- *Traffic engineering* to improve flows of *all* vehicles, or to reserve certain traffic lanes for truck use part of the day;
- *Auto-free zones* with exclusive access for pickup and delivery (PUD), emergency, and public transportation vehicles;
- *Prepaid shipments* to save 5 to 10 minutes per consignment;
- *Use of taxicabs*, where appropriate, to integrate small shipment PUD into their operations (e.g., when cruising);
- *Dial-a-truck* similar to the dial-a-ride concept for passengers;

- *Improved route scheduling* to reduce the distance a truck must cover to serve a particular group of customers;
- *Improved route consolidation* to reduce the number of trucks required to serve a given area;
- *Economic incentives* (e.g., road pricing) to increase the price of travel in congested areas during certain hours of the day, and thereby encourage a number of other alternatives proposed here (e.g., improving routing, scheduling, and consolidation); and
- *Local regulation* permitting only a limited number of trucks providing distribution services to operate in congested downtown areas.

LONG-RANGE IMPROVEMENTS

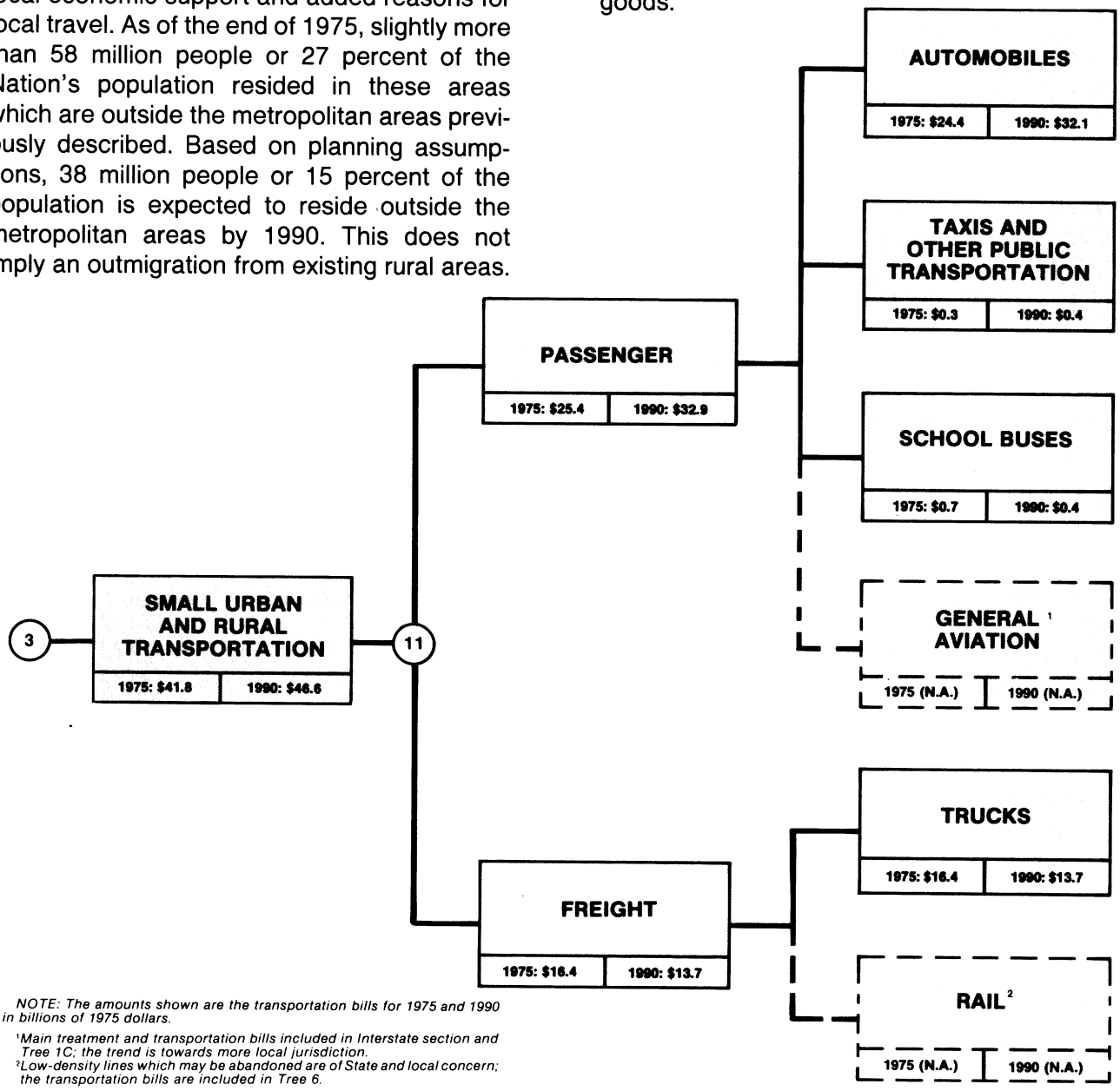
Finally, there are improvements which require construction of new rights-of-way or of new systems or major modifications in existing systems and which consequently require a long-range perspective, i.e., 3 to 5 years as a minimum, and in some cases 10 to 20 years or more. Such improvements include:

- *Improved urban design* to better provide for freight flows (e.g., Etarea, a new town planned as a satellite city for Prague) and designed to minimize freight costs by means of automated distribution systems linking households to retail outlets;
- *Improved building design* to include solid waste disposal systems (e.g., in Sweden and Disney World, Florida) and underground (or at least offstreet) truck docks;
- *Improved truck design* to meet the special requirements of urban PUD (e.g., an electric engine to improve fuel economy and reduce noise and air pollution, greater security against theft and hijacking, a configuration and turning radius compatible with urban conditions, and innovations in carousel container systems to facilitate locating shipments on the vehicle, loading and unloading);
- *New systems* designed exclusively for freight (e.g., automated underground systems or pneumatic tubes of the type used to transport mail in Paris and London) or for joint use of passengers and freight (e.g., automated guideway transit with interchangeable freight or passenger vehicles, with the network laid out explicitly to serve both types of demand); and
- *Communications technology advances* to improve communications between shippers, carriers, receivers, and urban traffic control centers; to reduce the numbers of person trips (and the induced freight flow); and to reduce the flow of printed media which requires physical movement.

CHAPTER XIII
Small Urban and Rural Transportation

This section addresses transportation outside the metropolitan areas—transportation in the scattered small towns and cities and in rural counties. The economy of such areas is usually supported by agriculture, forestry, mining, or some other relatively undiversified economic base. Recreational attractions such as seaside and mountain parks and resorts provide both local economic support and added reasons for local travel. As of the end of 1975, slightly more than 58 million people or 27 percent of the Nation's population resided in these areas which are outside the metropolitan areas previously described. Based on planning assumptions, 38 million people or 15 percent of the population is expected to reside outside the metropolitan areas by 1990. This does not imply an outmigration from existing rural areas. On the contrary, it results from such rural areas being defined increasingly as urban.

The local transportation in these areas takes place almost entirely by automotive vehicles, and as figure XIII.1 shows, 96 percent of the amounts spent for local passenger travel was spent on personal auto travel. In these areas, local trucks move the preponderance of goods.



NOTE: The amounts shown are the transportation bills for 1975 and 1990 in billions of 1975 dollars.

[1]Main treatment and transportation bills included in Interstate section and Tree 1C; the trend is towards more local jurisdiction.

[2]Low-density lines which may be abandoned are of State and local concern; the transportation bills are included in Tree 6.

Figure XIII.1. Transportation Tree.

PASSENGER TRANSPORTATION

The transportation problems in the nonmetropolitan small urban and rural areas differ substantially from the problems in metropolitan areas. In contrast to metropolitan areas and interstate facilities, congestion, parking, and pollution are rarely pervasive problems in nonmetropolitan areas. Additionally, diversion of persons from single occupancy automobiles to other modes does not result in as great a net benefit as it does in metropolitan areas. In fact, the lack of alternatives to the private automobile is perhaps the major transportation problem in nonmetropolitan areas, although the automobile is the ideal mode, because of the characteristics of these areas as well as the vehicle and service characteristics of automobiles. The almost exclusive dependence on the automobile is not bad except insofar as it has inhibited the establishment of alternatives for persons who, for reasons such as low income and physical handicaps, lack automobiles. Unfortunately, a substantial number of persons in nonmetropolitan areas fall in this category. Therefore, transportation planning for small urban and rural areas between 1975 and 1990 must, by necessity, focus on this group which differs from other groups because of its immobility.

Tripmaking

The importance of the private vehicle to nonmetropolitan residents can be deduced from the very high percentage of licensed drivers in the small towns and cities and in rural counties. Table XIII.1 shows the inverse relationship between the size of place of residence and percent of residents licensed to drive. Additionally, vehicle ownership is also higher in nonmetropolitan areas than in SMSA's. In 1973, 36.5 million vehicles—among them 27.1 million autos and 9.4 million trucks—were registered in nonmetropolitan areas. The percentage of households lacking either a truck or an automobile declined from 14.1 percent in 1970 to 13 percent in 1975. This compares with a decline from 17 percent to 15.7 percent for the United States as a whole during the same period. Whereas only one-fourth of nonmetropolitan households had trucks in 1971, nearly a third had trucks in 1974. The small percentage of households with a truck but no automobile increased from 0.9 percent in 1970 to 1.9 percent in 1975.

Table XIII.1
Percent of Persons 16 Years of Age and Older With Driver Licenses by Place of Residence

Place of residence	Percent with driver licenses			Total drivers (thousands)
	Males	Females	Total	
Unincorporated areas	90.0	68.8	79.2	35,961
Incorporated places				
Under 5,000	90.9	67.4	78.8	10,755
5,000 - 24,999	90.5	66.9	78.2	18,280
25,000 - 49,999	87.8	66.4	76.6	7,286
50,000 - 99,999	86.2	59.5	71.8	7,962
100,000 - 999,999	84.5	54.5	68.3	16,652
1,000,000 and over	68.2	32.5	48.8	6,090
All incorporated places	85.4	58.1	70.9	67,025
All areas and places	87.0	61.5	73.6	102,986

Source: Based upon unpublished table H-1 from the Nationwide Personal Transportation Survey conducted by the Bureau of the Census for the Federal Highway Administration, 1969-70.

Private vehicles provide ideal transportation for nonmetropolitan areas, and extremely low use is made of other transportation modes. Table XIII.2 shows the modal split for the journey to work. Seventy-nine percent of nonmetropolitan workers relied on automobiles for the journey to work, 9 percent walked to work, and 6 percent worked at home. The less than 1.5 percent who used cabs or buses indicates the absence of alternatives to the automobile.

TABLE XIII.2
Modal Split of the Journey to Work in Non-Metropolitan Areas

Mode	Total		Urban		Rural	
	Number (thousands)	Percent	Number (thousands)	Percent	Number (thousands)	Percent
All Workers	22,730		9,996		12,734	
Private Car Driver	15,001	66	6,778	68	8,224	65
Private Car Passengers	2,953	13	1,318	13	1,634	13
Bus or Streetcar	203	0.9	117	1	85	0.7
Taxicab	88	0.4	76	0.8	13	0.1
Walk	2,054	9	1,143	11	911	7
Worked at Home	1,502	7	219	2	1,283	10
Other	930	4	345	3	573	4

According to Department of Transportation surveys, three-fourths of the residents of unincorporated places who used private transportation for the worktrip had no public transportation alternative. Public transit is not an alternative for the 89.3 percent of workers from towns under 5,000 who used private transpor-

tation to work. Similarly, 68.2 percent of the workers living in towns with populations between 5,000 and 24,999 and 51 percent of the workers living in towns with populations between 25,000 and 49,999 depend, by necessity, on automobiles or trucks to get to their work.

One reason for the lack of public transportation is the high operating cost for long trips in low-density areas with dispersed trip ends. Aggregated journey-to-work data for all modes reveal that the average home-to-work trip length is 11.7 miles in unincorporated areas and 8.2 to 9.3 miles in small urban places.

Although data on the number of bus systems in nonmetropolitan areas are sparse, the American Public Transit Association has recorded some statistics broken down by population size. For example, the number of transit systems for "urban places" populated by less than 50,000 declined from 395 in 1972 to 313 in 1974. Considering that there were 3,042 nonmetropolitan communities according to the 1970 U.S. Census, not to mention the number of metropolitan "urban places" with populations under 50,000, the gross lack of bus transportation is apparent. The drop in revenue passengers for small urban places from 104 million in 1973 to 77 million in 1974, a decrease of 26 percent following a drop of 53 percent between 1960 and 1973, may be a consequence of diminishing bus service.

Very little information about taxicabs in nonmetropolitan areas exists. One study of taxicabs indicated that cabs were more plentiful in small cities than in large cities across the United States. The median ratio of active taxicabs to 1,000 population in these small cities was 1.22 in contrast to a ratio of 0.57 for large cities. On the other hand, the Senate Committee on Agriculture and Forestry contends that taxis are primarily an urban mode, noting that 57 percent of West Virginia's cabs were located in 10 counties while 8 counties had only 1 cab and 10 had none.

The International Taxicab Association (ITA) reported 161 nonmetropolitan areas in its membership as of mid-November 1975. Using the number of licenses as a proxy for active cabs, the cab per 1,000 population ratio for ITA nonmetropolitan members was 0.87 for cities with populations 26,000 to 50,000, 0.71 for cities between 6,000 and 25,000, and 4.85 for places between 1,000 and 5,000. The ratio for the smallest areas is probably highly inflated because the sample consisted of only five areas. In view of the fact that ITA is a voluntary organization and charges members dues of $4 per cab with a minimum of $25, it is safe to assume that many small areas are not ITA members, although they may have at least one cab.

Therefore, it seems probable that some taxicab service exists in nonmetropolitan areas, although the extent and adequacy of service cannot be readily determined. Given the high automobile ownership in nonmetropolitan areas, it may be hypothesized that cabs are used infrequently and predominantly by people who do not have automobiles available to them.

Characteristics of Autoless Persons

Most likely to be adversely affected by the lack of public transportation are the poor, the aged, and the handicapped. (See "Services to Special Populations" section for general discussion of these groups.) In 1974, 39.9 percent of persons in households with income below the poverty level lived in nonmetropolitan areas. This was a decrease from 40.1 percent in 1973 and 43.8 percent in 1969. It is interesting to note that the percentage of households without a car or truck (13.7 percent) corresponds to the percentage below the poverty level (14 percent) in 1973. If the assumption is made that disposable personal income continues to increase in constant dollars at the present rate of 1.9 percent per year for both metropolitan as well as nonmetropolitan areas (see the Planning Assumptions section of ch. I), then only a small percentage of households should be without private vehicles in the future.

The elderly are probably relatively the worst off with respect to the lack of public transportation. Some of the 24.6 percent of nonmetropolitan families who depended on social security income in 1973 may have been unable to afford the cost of a private vehicle—operation, maintenance, repair, and insurance—let alone the cost of a replacement vehicle when it becomes necessary. An automobile, however, may be less of a financial burden to the elderly of the future for several reasons. First, although 20.3 percent of nonmetropolitan

residents over 65 had incomes below the poverty level in 1975, the diminishing poverty predicted for the population as a whole should reduce considerably the proportion of poor elderly. Furthermore, most future retirees will be covered by social security insurance which now escalates at a rate more nearly commensurate with increases in the cost of living. The aged in 1990 will include some of the younger members of the aged population of the 1970's, plus some persons who are middle aged in the 1970's. The latter differ markedly from the former in terms of education and lifetime earnings. Whereas over half the over-65-year-old population in 1970 had only an elementary school education, over half of the population over 50 had at least a high school education.

An increasing percentage of elderly persons living in low-density areas both within and outside SMSA's may be expected in the future. As long as the elderly are not mobility restricted (over 80 percent of the elderly in 1970 did not have health-related mobility constraints), many will remain in the low-density automobile-dependent areas where they spent their working years or will migrate into low-density automobile-dependent areas blessed with natural amenities such as lakes and mountains. Thus, lifestyle rather than age will dictate residential location choice, activity patterns, and travel demands.

Advances in medicine and safety and increases in longevity will result in more people living to the age of 80 and beyond. Unlike persons just past retirement, physiological changes in very old persons will probably interfere with mobility. If the very old continue to live in the low-density areas where many of them were living after retirement, some form of public transportation will be imperative. Although the number of their activities and trips is likely to be curtailed, some tripmaking will be necessary. Even though they will constitute the primary users of public transportation, barring a fuel-shortage-induced diversion from the automobile, small numbers of nondrivers and persons in one- and zero-car households may also use public transportation.

Transit Options

The mixture of modes and services that will be implemented in a nonmetropolitan area will naturally depend on the circumstances and characteristics of a particular area. The State may take an active role in planning for these areas because of the shift in population growth to nonmetropolitan areas and increased national attention to problems of rural areas. Furthermore, States are familiar with local problems including problems of the rural-urban interface and can provide technical assistance. An indication of State interest is the work under way as of June 1975 in Pennsylvania, Massachusetts, New York, West Virginia, Tennessee, North and South Carolina, Iowa, and Oregon.

Except for the larger towns of 25,000 to 50,000 population or areas where trip ends are somewhat concentrated, demand-responsive rather than fixed-route services are recommended, especially since the majority of potential riders are elderly and handicapped. Furthermore, demand-responsive systems may be established without preconceived estimates of demand. Although operating costs of flexible-route buses are approximately 50 percent higher than fixed routes for the same vehicle productivity, if demand is less than 100 passengers/square mile/hour, the flexible-routes provide superior service for the same total cost.

One way to minimize cost for components other than labor is to use existing vehicles and facilities. For example, various kinds of buses can be used for carrying persons from few or many origins to one destination. However, school buses and military vehicles may be uncomfortable and poorly designed for physically handicapped and elderly persons. Table XIII.3 presents data on State statutes and regulations dealing with the use of school buses for nonschool-related transport. Precedents set in England and Scandinavia for transporting rural residents in postal vehicles may provide some insight into the use of mail delivery trucks. Probably passenger and mail separation would be required. The use of public agency vehicles for persons other than clients may be proscribed by statutes or regulations at any level of government.

The proliferation of Federal social service programs (93 as of 1974), which include transportation costs in permitted supportive services, has contributed to the inefficiency of rural transportation. Using 2 percent of authorized or

Table XIII.3
Summary of State Statutes and Regulations on Use of School Buses for Nonschool Uses as of September 1974

Status of State	Number	States
Have statutes explicitly allowing use of school buses by elderly for transport	11	Colorado, Idaho, Indiana, Kansas Iowa, Michigan, Nebraska, New York, South Dakota, Washington, West Virginia
Have statutes explicitly allowing more general uses of school buses in which the elderly could participate	8	Kentucky, Maine, Minnesota, Montana, Nevada, New Mexico, Oregon, Virginia
Leave use decision as local option (either through absence of any State law or broad interpretation of law)	13	Alabama, Alaska, Arizona, Arkansas, California, Connecticut, Maryland, New Hampshire, North Dakota, Tennessee, Utah, Vermont, Wyoming
Prohibit use of school buses for nonschool uses (either through restrictive statute or narrow interpretation)	14	Florida, Georgia, Illinois, Louisiana, Missouri, Mississippi, North Carolina, New Jersey, Ohio, Oklahoma, Pennsylvania, South Carolina, Texas, Wisconsin
States primarily served by privately owned school bus fleet on which there are some restrictions on availability of vehicles.	5[1]	Hawaii, Massachusetts, District of Columbia, Delaware, Rhode Island
TOTAL	51[1]	

[1]*Includes the District of Columbia.*
Source: Telephone survey of the States and the District of Columbia.

appropriated program funds as a rough approximation for transportation expenditures, $540 million would have been available from Federal social service programs alone in 1974. Because most programs are aimed at a very restricted target group, and, therefore, sharing of vehicles by clients of different categorical programs is generally precluded, this has led to both redundancies and exclusions in the transportation services provided.

Low-cost transportation, which may be less stigmatized and more universally beneficial than social-service-related transportation, may be obtained by strengthening or formalizing existing "friends and neighbors" carpooling. Although both free and compensatory ride services are possibilities, the former may be easier to implement because for-hire regulations and subsequently higher-than-regular private automobile insurance rates are probably circumvented by voluntary service. Mobility clubs can be established to match potential riders with drivers. If dispatching is voluntary, the cost of a mobility club is minimal—office rent, phone, and electricity.

In areas where taxicab service exists, lower fares and more efficient vehicle use may be produced if ordinances and State laws prohibiting jitney service and shared rides are revised. Communities interested in providing more comprehensive public transportation than would result from the above approach may establish a combination of taxicab exclusive ride and demand-responsive services at different fares. Past experience with dispatching demand-activated service and low-demand densities probably make taxicab operations better candidates than transit operations for providing demand-responsive service.

The delivery of commodities or services to users has had only limited testing. Its effectiveness seems limited to meeting only a selected proportion of overall needs.

Federal interest in rural transportation as a primary function rather than adjunct to social service programs is indicated in the Federal-Aid Highway Act of 1973 and Section 4(c) of the Urban Mass Transit Act of 1974. The first established the Rural Highway Public Transportation Demonstration Program for 2 years beginning in fiscal year 1975. The second provides $500 million during the period from 1975 to 1980 for planning and program development, demonstration projects, and capital assistance in nonurbanized areas.

A System for Emergency Action

It has been demonstrated many times in recent years that lives can be saved and injuries reduced by expeditious treatment of those experiencing potentially fatal or crippling attacks of illness or injury. Expeditious transportation can be the key to bringing emergency medical care and patients together in time to save lives. Larger urban areas are likely to be served well by local hospitals and ambulances or other rescue services. However, some rural areas are remote from hospitals and surface ambulance service may be relatively slow and expensive.

Today, the combination of resources needed to provide vastly improved emergency service nationwide to those who are isolated, in need, and whose location is known appears to be available. Earlier in this document, a figure of $400,000 per life saved was attributed to other lifesaving proposals. If only 1 rescue attempt in 100 saved a life, it would be worth spending up to an average of $4,000 on each rescue attempt.

It appears there might be substantial gains from nationwide design and implementation of a national rescue system. This system would serve isolated persons needing emergency aid

using netted communications and helicopters and other expeditious forms of transport.

While many worthwhile programs continue to improve the overall readiness for response to transportation emergencies and provide transportation for response to other emergencies, there is often a lack of coordination, standardization, and overall direction. This deficiency can lead to inadequate cross-utilization of resources in a geographical area, omissions in coverage, substandard training, and confusion in control and coordination during an emergency. While such confusion is not intentional or the fault of one individual, it may indicate symptoms of deficiencies in organization, control, and policy direction.

It is envisioned that improved emergency response could be achieved by a systems approach to organization, and integration of resources into a cohesive and efficient network of services available on a nationwide basis.

Such a system could be built on the services that already exist and serve some areas. These include:

- *SAR* — The National Search and Rescue Plan, an outgrowth of the air-sea rescue services of World War II, is administered through an interagency committee chaired by the Commandant of the Coast Guard. The military services are represented through Department of Defense membership with the Federal Communications Commission, Department of Commerce, and NASA as participating members. Other elements of the Department of Transportation are also represented. The worldwide network is primarily aviation- and maritime-accident-response-oriented although it also assists local communities in civil search efforts through mutual support agreements in many areas.

An ancillary organization has recently been formed, the National Association of SAR Coordinators. This organization is essentially a federation of State SAR coordinators representing participating States. Its goal might be stated as coordination, standardization, promotion, and enhancement of the search and rescue activities and capabilities of the various States. It is a private foundation.

- *EMS* — Emergency medical services include the expeditious treatment of emergency medical problems through improved medical services, transportation, communications, equipment, and training. Although this activity includes transportation to medical facilities from residences, a primary emphasis has been responding to transportation accidents, specifically highway injuries. The Department of Health, Education, and Welfare chairs an interagency committee (mandated by Congressional action) containing membership from Department of Transportation as well as members representing other interested government and private agencies.
- *MAST* — Military Assistance to Safety and Traffic is a joint Department of Transportation-Department of Defense program under which specified Army and Air Force helicopter organizations are made available to local authorities when possible (as a secondary function) to assist in emergency air ambulance evacuation and transportation. This program augments but does not replace civil ambulance capability in specified areas of the Nation.

Cities, counties, metropolitan areas, and local jurisdictions participate in emergency services and offer many resources such as ambulances, rescue squads, hospitals, fire rescue organizations, mountain climbing expertise, security police organizations, 911-emergency telephone service, communications networks, etc. These resources are operated privately as government-sponsored volunteer services.

It is recommended that a study be undertaken to design such a system, basing the design where practical on existing activities.

SMALL URBAN AND RURAL AREA FREIGHT

Freight movement in rural and small urban areas is dominated by the movement of goods between production/consumption sites and the long-haul intercity modes. The efficiency of rural freight movement is a function of the characteristics of the interstate networks and their interface with the rural market. This section looks at the basic problems associated with this interface, while the problems and issues of the direct intercity freight modes are considered elsewhere.

Changes, analogous to the rural demographic shifts outlined above, are anticipated to continue to have an effect on the agricultural and manufacturing sectors of the rural econ-

omy. Basically, these are (a) intensified farm production and exportation with attendant specialized and seasonal transportation demands, and (b) increased rural manufacturing and consequent increased production of high-value goods.

At the same time, the supply of transportation services has been affected by the improvements in the rural secondary, primary, and interstate highway systems, lessening, but not always ending, what was once nearly total dependence on an extensive rail branchline network. As an indication of the trend of improvements in road service capacity, surfaced rural collector road mileage increased from 27 percent to 77 percent of the total mileage in the period 1962 to 1972.

The resulting decline in use and importance of many branchlines has led to proposals to abandon substantial numbers of branchlines, with consequent effects on a small but significant number of branchline-dependent shippers. The necessary shift to other modes of freight shipment is not, in most cases, expected to place a significant physical strain on other freight modes, or incur economic hardships to shippers. Nevertheless, strong feelings persist as to the need to retain segments of the rail network that are, by some estimates, clearly inefficient for the services they provide.

The Issue of Rail Abandonment

The decline in rural branchline accessibility is primarily the result of two factors: (a) neglect and abandonment of excess underutilized capacity, a legacy of the historical overbuilding of the rail system, and (b) changes in rail operations and specialization in rail car characteristics.

Most of the Nation's branchline network was developed when direct service required a rail link to almost every shipper. Since the early part of this century when most of the present network was in place, competitive and more effective distribution systems have come into being which can serve local shippers much better than railroad branchlines. While the viability of branchlines declined, regulatory policies adopted a viewpoint that, as long as part of the railroad was profitable, the branchlines would be kept open if the "public convenience and necessity" require it, as that term has been defined by the Interstate Commerce Commission.

While rail abandonment has cut the amount of rail line in the United States from an historical high of 254,000 miles in 1916 to 200,000 miles in 1974, the pressures for rationalization of the rail system have intensified in recent years. As an indication of the magnitude of excess trackage, the 1976 ConRail reorganization plan for the Northeast identified 7,371 miles of uneconomic rail line eligible for abandonment or subsidy in 16 States. (A line is considered uneconomic if it fails to generate revenue to cover operating and maintenance expenses.) This represents 25 percent of the total mileage subject to consolidation, but this portion of the system generated only 2.2 percent of the total traffic. It is estimated that each mile incurs a loss of $4,000 annually.

When the ConRail plan was implemented in 1976, provisions in the Railroad Reorganization provided for Federal and State subsidies to retain light-density lines in service which were identified as providing an essential service. The Federal participation in this subsidy is scheduled to be eliminated after 5 years. As a result of this provision, 3,200 miles of otherwise uneconomic lines are being retained through subsidy.

The Railroad Revitalization and Regulatory Reform Act of 1976 has extended this policy to the remaining States, subject to State establishment of a State rail plan. Under this Act, the Secretary of Transportation is authorized to provide financial assistance to the States for rail freight assistance programs in four areas:

- Rail service continuation payments,
- Purchasing an abandoned rail line for possible use in the future (rail banking),
- Rehabilitating and improving rail lines,
- Providing alternate distribution means if such means would be less expensive than rail service.

The Federal share of the costs of any rail service assistance program shall be as follows: (a) 100 percent for the period from July 1, 1976, to June 30, 1977; (b) 90 percent for the period from July 1, 1977, to June 30, 1978; (c) 80 percent for the period from July 1, 1978, to June 30, 1979; and (d) 70 percent for the period from July 1, 1979, to June 30, 1981. For the period from July 1, 1979, to June 30, 1981,

the Secretary may make such adjustments in the percentage level of the Federal share as may be necessary and appropriate so as not to exceed the maximum amount of funds authorized.

It is a State responsibility to develop general evaluation criteria.

Under this program, approximately 4,200 miles of light-density lines are being reviewed for subsidy or abandonment in the 33 States outside the Northeast, and likewise, 1,800 miles owned by solvent lines in the Northeast. Decisions have not been made as to how much is to be retained in service through use of subsidy payments to offset operating losses; an estimate is approximately one-third to one-half of the eligible amount. It can be anticipated that more lines will be abandoned in the future as more measures of the economics of railroad/shipper profit maximization become available and the responsibility for subsidy payments is further shifted to the individual States.

The DOT, in an analysis of the potential for rail abandonment outside of the Northeast, estimates a possible excess supply of uneconomic light-density lines of 25,500 miles, 976 segments of an average length of 26 miles (see table XIII.4). This may be an overestimate in that the impact of abandonment on other lines has not been considered, but the implication is that approximately 20 percent of the existing rail lines in the United States are not viable by economic criteria, and thus are candidates for abandonment. Such abandonment, however, must consider future shifts in traffic patterns such as those resulting from the development of Western coal.

Table XIII.4
Miles of Uneconomic Light-Density Lines

Region	Existing Miles (1974)[1] (miles)	Uneconomic Light-Density Lines[2] (miles)	Percent Uneconomic Light-Density Lines (percent)
South Atlantic	16,688	1,100	6.6
East South Central	14,911	900	6.0
West South Central	25,577	3,600	14.1
West North Central	48,337	13,700	28.4
Mountain	20,266	3,600	17.8
Pacific	15,183	2,600	17.1
Midwest-Northeast[3]	61,184	15,575	25.4
Total	202,146	41,075	20.3

[1] *Association of American Railroads,* Yearbook of Railroad Facts, *Washington, D.C.*
[2] *From computer analysis.*
[3] *17-State ConRail region.*

The impact of this amount of abandonment is estimated by the DOT to be primarily on the agricultural sector, with the lumber and wood products sector moderately affected (see table XIII.5). If the assumed 25,500 miles in the 31 States outside the Northeast were abandoned, estimates are that 4 to 5.5 billion ton-miles (620,000 rail-car loads) of traffic will be diverted to other modes, primarily trucking. The switch to trucking would result in 150 to 300 million additional truck-miles annually, or, compared to the 40 billion truck-miles in the United States, a less-than-1-percent increase. Fuel consumption would increase by 0.05 percent within the trucking industry (an additional 30 to 50 million gallons annually). The operation of the 25,500 miles of uneconomic light-density lines causes an annual loss of $150 million; abandonment would result in an 18-percent increase in railroad net revenues, at the present time.

Table XIII.5
Estimated Use of Uneconomic Light-Density (ULD) Lines Outside the Northeast

Commodity	Rail Shipments (million tons)			
	National Total	Regional Total	On ULD Lines[1]	Percent of Total on ULD
Agriculture				
Wheat	44.5	40.9	8.8	21.5
Corn	31.6	18.0	3.0	16.7
Other	46.6	30.7	4.6	15.0
Fertilizer	17.3	11.6	1.2	10.3
Coal	288	56.1	.5	.9
Manufactured Products	370.3	207.4	3.7	1.8

[1] *31 States outside the Northeast.*
Source: Federal Railroad Administration.

Changes in rail operations and railcar fleet characteristics are a major factor affecting rural light-density rail line viability. The trend in rail operations is toward specialized high capacity (e.g., 100-ton hopper) cars and large lot or unit trains, and many of the light-density branch lines are not capable of handling this size of car or train. In the last 15 years, the number of covered hopper cars has increased 293 percent, while the number of narrow-door boxcars (the type of car usable for branchline service) has declined by 50 percent.

While the annual highway needs study of FHWA indicates the costs of improving a large amount of rural roads to a level of service compatible with heavy truck traffic, the cost of providing alternative routes to uneconomic light-density lines is a small percentage of this

amount. Although highway maintenance costs tend to increase with additional truck traffic, weighed against the cost of upgrading branch rail lines to 25 mph, the incremental requirement for highway costs is slight.

Large-volume shipments (i.e., grain) would be the type of freight movement most affected by rail abandonment. To gain the low cost of large-volume movements, modern centralized terminals generating multiple carloads are required. They produce savings for carriers and shippers compared with scattered loading points blanketing the branchline network. The fractionalized nature of scattered sidings along branchlines will not allow these economies. The understanding of logistical systems is reaching the point where alternatives to branchlines that will benefit both shippers and carriers are starting to emerge.

Rural Freight Transportation Alternatives

Given that rural transportation problems result from changes in the rural/intercity freight interface, several alternatives can be offered. The options are primarily (a) preserving rail service by improving the viability of uneconomic light-density lines, or (b) increased use of trucking, either for direct shipment or transshipment to other modes. Optimal solutions are likely to be some combination of these alternatives.

- *Improving the viability of uneconomic lines through cost reduction* — This can be achieved through curtailment of way maintenance, reduction of train crew size, reduction of train frequency, reduction or elimination of property taxes, operation of line as a short-line railroad, and redefinition of line segments. Table XIII.6 summarizes the relative advantages of these measures.

Table XIII.6
Overview of Specific Cost Reduction Measures to Improve Viability

Action	Economic Advantages	Economic Disadvantages	Feasibility Considerations
Curtailment of Way Maintenance	Up to 75 percent reduction in immediate right-of-way costs	Accident risks, increased rehabilitation costs later in time or eventual loss of the operational capability	No apparent legal restrictions
Reduction of Train Crew Size	15-40 percent reduction in labor costs; up to $15 million in reduced deficits annually	Possible displacement of labor	Possible prohibition by State law; contrary to current collective agreements
Reduction of Train Frequency	5-20 percent reduction in total costs; up to $25 million in reduced deficits annually	Service reduction to shippers consignees; possible displacement of labor	Labor negotiations likely
Reduction/Elimination of Property Taxes	10-25 percent reduction in right-of-way costs	State funding for local tax replacement may be required	Possible State constitutional prohibition against selective taxation; possible prohibition of the tax replacement by State law
Transfer of Ownership	Costs of operation may be restructured and reduced; possible future renegotiation of rates by shippers	Possible increase in total transit time would increase inventory costs; possible adverse changes in equipment availability	ICC approval required
Operation of Line as Short-Line Railroad	40-60 percent reduction in labor costs; service improvements; substantial cost savings	Capital amortization; possible difficulties in arranging favorable rate divisions	Possible conflicts regarding reversion of property rights
Redefinition of Line Segments	Concentrate demands for service; reduce unprofitable operations	Some shippers may lose direct service, increased costs result	Regulatory approval required

- *Truck/rail transshipment* — Most bulk commodities are trucked at least some distance to rail terminals. Abandoning branchlines would increase the distance and thus incur additional marginal trucking costs, which may possibly be compensated by lower rail costs. For other shipping with direct access to branchlines, overall costs would be higher. An additional cost may be the necessity to upgrade certain roads and bridges. This alternative can be economically favorable for shipments beyond 400 to 500 miles.

For bulk commodity shipments (i.e., grain), truck transshipment can be combined with a rationalization of subterminals to make effective use of unit trains or other means of long-haul movement of freight. The alternative is often proposed by rail abandonment studies as

a cost-effective alternative to the storage and shipment needs of grain production.

- *Direct trucking* — This is the fastest mode of freight movement and is currently used for most high-valued shipments. Because of the relatively high cost for transporting bulk commodities, little diversion may be expected from long-haul, low-value commodities.
- *Trailer on Flat Car/Container on Flat Car (TOFC/COFC)* — The primary advantage of containers is reduced handling, thus less damage and loss of the contents. This mode is economically appropriate for medium- and high-valued shipments of over 400 miles, but its usefulness is limited by the need for loading facilities, low backhaul potential, high investment costs, and for local loading of agricultural commodities, loss of quality control (e.g., drying of grain). For bulk quantities, unit train operations may prove to be a better alternative.
- *Truck/barge* — Barge movement of bulk freight can be cheaper than rail, depending on the availability and directness of waterways. Combined with truck transshipment of less than 300 miles, this can be economically competitive to rail shipment. Its attractiveness could be enhanced by the increased use of barges suitable for direct loading on oceangoing ships, such as LASH and SEABEE.
- *Relocation of firms* — As borne out in several retrospective studies on the effects of rail abandonment, a common consequence is relocation of firms to a surviving shipping point. This move is often combined with a redefinition of firm functions. The amount of relocation, on an aggregate scale, is difficult to estimate as each case depends on the particular situation.