

Emerging Patterns of Urban Growth and Travel

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•FUTURE changes in urban travel patterns and growth in urban travel demand, within 20 years' time, will require substantial innovation and broad expansion in our urban transportation system. These basic new transport needs will develop in response to growth and changes in the structure of employment and its intra-metropolitan area location, as well as the relative shift of metropolitan area population to the outside central city portions of metropolitan areas.

URBAN TRANSPORT NEEDS

Urban Travel Patterns

In the period of one generation, to 1985, urban travel patterns will experience a fundamental shift from a central city funneling orientation to that of a dispersed outside central city network. In the present scheme, travel patterns are dominated by workers living and working in central city, supplemented each day by a flow of workers living outside and commuting into central city. Less than one-third of all workers live and work outside of central city. By 1985, travel patterns will be reversed. One-half of all workers will live and work outside central city, supplemented each day by a margin of workers living in central city and working outside central city. Workers living and working in central city will make up only one-fifth of the work force. Workers commuting into central city will be equally matched by workers flowing out of central city. The typical urban travel pattern will be from one outside central city origin to an outside central city destination, over a longer travel route, without an increase in travel time. The line-haul trip to the central business district, hardly representative even of present travel patterns, will be an even smaller share in the coming generation.

Urban Travel Demand

Urban travel demand will increase notably in response to population growth, shifts in employment and residence location, the rise in household income levels and a related augmented preference for auto use, and changes in urban travel patterns. Daily metropolitan area person trips will double as a 50 percent rise in metropolitan area population is combined with a 50 percent increase in autos per household. Vehicle-miles of urban travel will much more than double in line with the increase in auto ownership, the changes in urban travel patterns, a one-third expansion in the urbanized land area, and an increase in average trip length. Auto-driver trips per person will rise by one-third in accordance with the increase in autos per household. Average trip lengths will be extended by one-third as a consequence of the modification of urban travel patterns. The overwhelming share of vehicle-miles will be in the outside central city portion of metropolitan areas. In effect, metropolitan area population 50 percent larger will double the present number of trips, whose length will be one-third longer, in line with the suburbanization of employment and residence locations, the up-grading of income levels and auto ownership, and the inversion of urban travel patterns.

Auto Ownership

Autos in use will more than double and will be even more predominant as the preferred mode of urban transport. A greater share of households will use a larger number of automobiles. Auto ownership is closely associated with the distribution of households by income levels, the age of household heads, the regional location of the population, and the intra-metropolitan area location of residences. Households with incomes of \$15,000 and over have more than twice as many autos as households with incomes of less than \$4,000. Households living outside of central city have a 50 percent higher level of autos per household than is the case for those living in central city. Households living in the West have a one-fourth higher level of autos per household than households in the Northeast. In line with the projected rise in household income levels, the growth and shift of metropolitan area population to the outside central city portion of metropolitan areas, and the greater growth rate of metropolitan area households in the West, autos per household in metropolitan areas will rise by 50 percent, and metropolitan area auto use will expand by one and one-half times. The outside central city portion of metropolitan areas will raise their share of autos from 38 percent, in 1964, to 53 percent, in 1985.

Travel Mode Preference

Virtually all of the increment in travel demand will be by auto. Public transit trips will gain only marginally, because of the changing urban travel pattern and the preference for auto use. The share of intra-metropolitan area daily person trips by auto, presently over 80 percent of the total, will rise to over 90 percent by 1985, with less than one-tenth of all trips made by public transit. In large central cities with a metropolitan area population of 1 million and over, nevertheless, public transit will continue to account for more than one-third of journey-to-work trips.

Rapid Transit

Rapid transit will be substantially improved in the 5 cities with such systems, and some 6 or 10 new rapid-transit systems may be developed in other large cities, but this will hardly change urban travel demand and travel patterns. Rapid-transit person trips will increase only fractionally even with the operation of new systems. Nevertheless, where rapid-transit systems are in operation, they will be an important element of improved travel into central cities and central business districts. With travel into central city increasing only marginally, it will be easier to combine a range of transport measures to alleviate congestion and improve the ease of travel.

Consumer Expenditures on Urban Transport

Consumer expenditures on transport are third in importance after food and housing. The share of the consumer dollar spent on auto use will rise, while that for public transportation will decline.

Households Without Automobiles

All will not be rosy, however. While the share of households with no automobiles will be reduced by more than half, from the present one-fourth of all metropolitan area households, almost one-fourth of large central city households may still own no automobile in 1985. This prospect, together with the decentralization of jobs in metropolitan areas and the dispersion of housing and schools, will make for a continued hardship for low-income minority groups, as well as the young, the old, and the infirm, unless the evolving urban transport system includes features for effectively increasing their mobility.

Demand for Urban Freeways

In the context of the prospective nature of urban travel patterns, travel demand, and travel mode preferences, the demand for urban freeway-type travel facilities will

dominate the expansion of the urban transport system. Nonlimited-access urban arterials, streets, public transit, rapid transit, and commuter railroads will continue to be an important part of the overall urban travel picture, but the configuration of future urban travel patterns, the doubling of trips, the expanded trip length, and the preferences for the auto travel mode, signify a prospect for a more than doubling of freeway route miles needed by 1985, after the completion of the urban portion of the Interstate System scheduled for 1972. In comparison with a present estimated need for some 12,000 route-miles of urban freeways, the requirement for 1985 may be 27,000 route-miles. This estimate of route-miles of urban freeway needed is based on the relationship of autos in use with freeway needs by metropolitan area size class, and central city-outside central city composition. Most of the addition would be for outside central city route-miles of freeways. Needed expansion of nonlimited-access arterials, in contrast, will be only some 50 percent plus above present levels. Urban freeways would account for the greater share of urban arterial and freeway vehicle-miles of urban travel.

Role of Urban Passenger Transport in the Economy

The urban passenger travel system is a major part of the whole economy, in terms of current expenditures on services and capital expenditures on facilities. Its share in the overall economy will increase over the next 20 years, in line with the expanding consumer preference for spending more of each additional dollar of income on urban transport and the increasing demand for more and better urban transport facilities and services. The aspect of the urban passenger transport system which bulks largest is that of automobiles and freeways. Of an estimated need for outlays of \$88 billion for all types of transport rolling stock and facilities, in the year 1975, to meet transport goals, for example, more than half would be required for autos and urban highways. The estimated transport expenditure need of \$88 billion for the year 1975 includes \$39 billion for autos, \$7 billion for urban streets and highways, \$19 billion for rural highways, \$7 billion for trucks, buses, and trailers, and \$6 billion for highway maintenance, rapid transit, and new urban transportation methods; the remaining \$10 billion is accounted for by the whole range of expenditures for railroads, ships and inland waterways, oil pipelines and air carriers, general aviation, airports, air navigation, hydrofoils, and air cushion vehicles. If these expanding expenditures signify a better supply of transport services, and an improved solution to urban transport needs, as well as a more efficient use of capital and manpower, thus contributing to the overall improvement in the productiveness of the economy, the role may be positive from all points of view. An improved, expanded and innovative urban highway system must be a major part of the evolving urban transport system, and will contribute to achieving these goals.

THE URBAN GROWTH CONTEXT

These prognoses for travel patterns, travel demand, and urban freeway needs flow from the perspective for urban growth in the context of the outlook for expansion of the national economy, and change in the structure of employment and its intra-metropolitan area location.

Future Urban Growth Patterns

In the generation to 1985, and in the framework of a larger but younger population, with higher income levels, living in an expanded urbanized area, there will be a substantial growth and shift of employment and residence location from central cities to the outside central city portion of metropolitan areas. There will also be a continued relative shift of economic activity, employment, and population to the Far West, though the North-East-Central megalopolis will continue to be the dominant center of population, production, and employment.

The nation will be principally an urban non-central city population; the bulk of residence, employment, and urban travel activity will be in the urban areas outside of central

cities. Population and employment levels in central cities will be hard put to hold to present levels. Virtually the whole increment in population and most of the increase in employment will go to the outside central city portions of metropolitan areas. New housing will be principally single-family units in metropolitan areas outside central city.

Central cities, nevertheless, will continue to be viable as growth in service activities—government, business, and personal services—offsets, in part, declines in central city manufacturing and trade. This prospect, together with the respite provided by the relative shift of employment and residence to outside central city, will facilitate the revitalization of the central business district and the rehabilitation and renewal of grey areas.

Expansion of the National Economy

In 20 years' time, the population will be one-third larger and household growth even greater. Beginning in the 1970's, the birth rate will rise, despite a decline in fertility rate, in view of the sharp increase expected in the number of women in the childbearing ages.

Production of goods and services is expected to much more than double, growing even more rapidly than in the post-1945 generation, though somewhat less than in the 1960-66 period, as a more rapid expansion of the labor force complements more advanced economic and fiscal policies to insure sustained growth. Production and employment structure will change. Services, in general, and state and local government activity, in particular, will be the growth industries of this coming generation. In manufacturing, machinery and chemicals will have the greatest growth. This prospect for expansion of the economy, and change in structure, has important implications for regional and urban growth, and the inter- and intra-metropolitan area location of economic activity.

Prospective economic growth and the broad expansion of per capita personal income will shift a large share of all households into higher income levels, and this, coupled with the younger age composition of the population, holds great significance for the related demand for housing, residence location, travel mode, and urban services.

Employment Growth, Structural Change, and Shift in Intra-Metropolitan Area Location

Employment in the economy as a whole will rise by some two-fifths, by 1985, somewhat more than the anticipated growth in population, in line with the increase in population 14 years old and over, and the greater participation of women in the labor force. This rise in employment will be made up of a lesser growth in manufacturing and trade, and a larger expansion of government and other service activities.

This prospective development has a fundamental implication for the intra-metropolitan area location of employment. In the period 1948-63, central city employment in metropolitan areas with a population of 1 million and over hardly grew at all, as declines in central city manufacturing and trade offset a rise in service activity. Outside central city employment almost doubled, with increases in manufacturing, trade, and services. In line with new manufacturing, trade and transport technology, and in their quest for more space and better communications, with easier access to both rail and highway networks, manufacturing and wholesale trade enterprises shifted to outside central city locations. Retail establishments followed the customers outside central city. Service activity employment expanded in both central city and outside central city.

Reports on industrial and commercial construction activity, by intra-metropolitan area location, over the last five years, an indicator of future employment location, suggest that these trends in employment location may be expected to continue.

These intra-metropolitan area location factors, combined with the inferences on change in structure, suggest that most of the increment in employment to 1985 will take place outside of central city. This will reverse the central city-outside central

city employment location distribution from 65 percent-35 percent in 1960, to 45 percent-55 percent in 1985.

Regional Location of Economic Activity

The Far West will continue to experience a population growth rate larger than that of the nation as a whole, favored by change in the structure of the national economy and the growing size of the migrating age group. Metropolitan areas of the North-East-Central megalopolis, stretching from Boston to Washington to Chicago, will continue to make up at least half of the nation's metropolitan area population. There are significant regional differences in urban travel patterns, and relative changes in the location of economic activity by regions, therefore, have important implications for future changes in urban transport systems.

Metropolitan Area Growth and the Intra-Metropolitan Area Location of Economic Activity

Metropolitan areas will undergo fundamental changes in structure as a consequence of the larger but younger population, higher household income levels, the change in production and employment composition, related changes in the location of employment and residences, and expansion of the urbanized land area. Virtually all population growth will be in the outside central city portion of metropolitan areas. The net increment in households will establish residences principally outside central city in accordance with the preference for greater space related to the rise in income levels, the younger age of household heads, and the shift of employment location outside of central city.

Since 1945, the outside central city portion of metropolitan areas has more than doubled its population, and surpassed that of central cities. Measured by the central city boundaries of 1950, central city population has not increased at all since that year. Since 1960, central city population, including that accounted for by the expansion of city limits, has been increasing at the very low annual rate of less than one-half of one percent. Large central cities have lost population. This relative shift of metropolitan area population reflects the effects of postwar mortgage lending institutional practices, postwar highway construction and automobile ownership, as well as population growth, employment location, and the rise in income levels.

For the future, the expected 50 percent increase in metropolitan area population, by 1985, will accrue wholly to the outside central city portion of metropolitan areas, raising their share of metropolitan area population to two-thirds. This will occur in the context of an upward shift of metropolitan area household income levels which will reduce the share of households with incomes of \$4,000 and less, from one-fourth, in 1965, to one-eighth in 1985, and raise the relative importance of the \$15,000 and over group from one-tenth, to one-third in these same years. Metropolitan area households will not only be more affluent, with a related preference for lower residential density outside central city, but a larger share of them will be in the "first home buying" age group. The share of households with heads under 34 years of age will increase by one-third from 1965 to 1985, making up one-third of all households in the latter year. In contrast, the 45-and-over age group, whose life-phase might support a return to central city, will increase only marginally in this period. These characteristics of higher income and younger age are also associated with a preference for single-family housing. The combination of higher incomes, younger age, single-family housing preference, westward population shift, and intra-metropolitan area employment location, all add up to an anticipated continuation of the relative shift of metropolitan area population residence location to the outside central city portion of metropolitan areas.

Household Formation and Housing Demand

Prospective housing construction in the 1970's and 1980's, to accommodate new households, replacements for demolitions, and the upgrading of housing demand in line with income growth, will increase our stock of housing by one-third and significantly

improve its quality and change its location. All of the net increment in the housing stock will be built in the outside central city portion of metropolitan areas; two-thirds will be single-family units and one-third in multi-family and other types of units. Substantial renewal and replacement will take place in central cities, without adding to the housing stock there. Housing structure type, value class, and location are closely associated with distinctive types of urban travel needs and preferences, and will be a principal determinant in shaping expansion and change in urban transportation systems.

Expansion of Urbanized Land Area

Over the next generation, urbanized land area will expand by one-third to accommodate an urban population growth of almost one-half. Transportation requirements for such an expansion in urbanized land area will be substantial and add a new dimension to the urban transportation system.

BOSTON REGIONAL AREA URBAN GROWTH AND CHANGES IN URBAN TRAVEL PATTERNS—A CASE STUDY

In-depth studies of urban growth and transportation needs for the Boston Regional Area, covering some 150 cities and towns in a 30-mile radius from downtown Boston, have recently been made by the Boston Metropolitan Area Planning Council and the Eastern Massachusetts Regional Planning Project, and throw significant light on the interrelation of prospective urban growth and changes in urban travel patterns. These studies, looking ahead to 1975 and 1990, envisage a Boston Regional Area one-third larger, in terms of population, with per capita income levels almost doubling by 1990, as the past decade's upgrading of industry structure and jobs continues over the next quarter century. In the past decade, though the Boston Regional Area population has grown at a lesser rate than that of the nation as a whole, per capita income levels have expanded at a faster rate than the national average. New, higher wage and higher productivity jobs in electrical machinery, instruments, transportation equipment, research and development, higher education, medical services, finance, insurance, and real estate, and tourism, have substituted for the decline in lower paying jobs in textiles, leather, and fishing.

Even with a slower prospective population growth than that of the nation as a whole, the Boston Regional Area is expected to experience very substantial growth and change in the structure of its economy, and in the intra-regional area location of employment, and population residence. The Core Area, comprising the City of Boston, Cambridge, Chelsea, and several other municipalities, is expected to continue to lose population and employment, with all and more of the increment in employment and population going to the outer rings of the regional area, in response to the changing structure and location patterns of industry, and rising incomes and residence location preferences of the population. Nevertheless, the Core Area is experiencing a revival, even with its declining population density, as the expansion of service activities spurs an ambitious renewal program, and this may be expected to continue.

In this context, intra-regional travel patterns are expected to undergo a fundamental change, and travel demand is expected to more than double by 1990, with outside core cities travel making up virtually all of the increment in travel needs, and accounting for the bulk of Boston Regional Area travel. As a consequence of change and growth in the characteristics of travel requirements, vehicle-miles of travel on limited-access urban freeways is expected to increase three-fold, whereas travel on nonlimited-access arterials would grow by only half. As a result, urban freeway travel in the Boston Regional Area, in 1990, would make up three-fifths of total arterial and freeway vehicle-miles, in contrast to their present two-fifths share. Rapid transit trips would increase by some 15 percent. Transportation plans, based on these types of prognoses, indicate the need for broad expansion of radial and circumferential urban freeways to meet travel demand and to enhance the accessibility and viability of the City of Boston.

The projected dominance of urban freeway-type travel in the Boston Regional Area, despite its slower population growth, its rapid transit system, and its more compact make-up, has great significance for the expanding role of urban freeway type travel in

metropolitan area growth in the nation as a whole. In Boston, as in other large and medium-size metropolitan areas, an expanded, improved, innovative, interconnected urban highway system, including radials and circumferentials, will provide an important part of post-1972 urban transportation needs.

PERSPECTIVES FOR GROWTH OF THE NATIONAL ECONOMY AND THE INTRA-METROPOLITAN AREA LOCATION OF EMPLOYMENT

In the coming generation, the magnitude and directions of growth in our national economy will bring with it a fundamental change in the structure and intra-metropolitan area location of employment. By 1985, central cities will no longer be the principal place of employment—marking a new turning point in the evolution of the economy. Elements in this basic change include the prospective growth and younger age composition of the population, an upward shift of households to higher income levels, a change in the composition of demand, and a broad expansion and change in the structure of production. With this, there will be a basic change in the location of economic activity, in line with new technology in manufacturing, trade and transport, and new levels of government, business and personal service activity.

Population

In the time of one generation, 1965-85, the nation's population will grow by one-third, a net addition of some 70 million inhabitants, representing a rate of increase comparable to the high population growth phenomena of the postwar generation, 1945-65. A large increase in the number of women of child-bearing age may be expected to raise the birth rate, despite a continued decline in the fertility rate. The anticipated large increase in the number of women of child-bearing age reflects another notable phenomena, the younger age composition of the population.

In the coming generation, to 1985, the under-45 population age group will grow by some 59 million, or one-third more than the increase in this same age group in the entire 35-year period, 1930-65. Of particular note is the extraordinary prospective increment in the 20-44 year age group, which had experienced only a marginal increase in the 1950-65 period (Fig. 1).

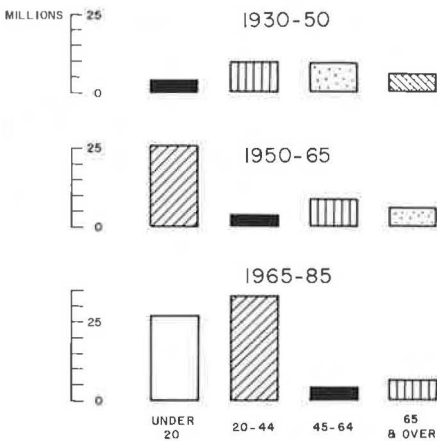


Figure 1. Population increase by age group.

Production

The larger but younger population growth will develop in the context of a more than doubling of the size of the economy in the next 20 years, in terms of the level of production of goods and services. With the new stage of sophistication of government and business fiscal and economic policy in the last decade, and a more rapid expansion of the labor force, future growth of the economy is expected to exceed that of the postwar period with its four minor recessions, though falling somewhat behind the extraordinary growth rate experienced in the 1960-66 period (Fig. 2).

Income Levels and Income Distribution

The order of magnitude of economic growth anticipated, will signify a broad upward shift of households to higher income levels. Even so, a small but still important share of households will still continue to live at poverty levels. Personal income, for the nation as a whole,

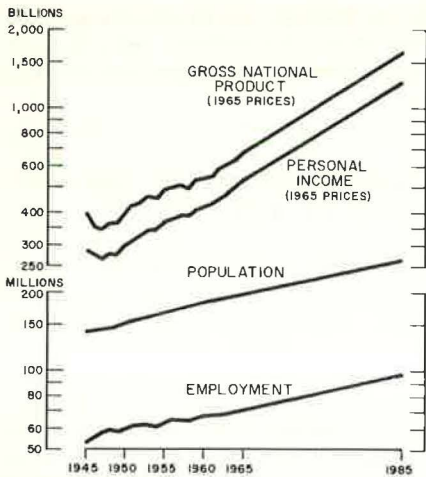


Figure 2. Growth in population, employment, production, and personal income.

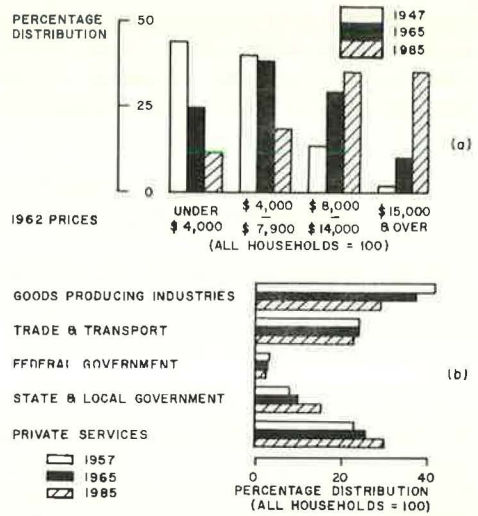


Figure 3. Distribution: (a) households by income level and (b) employment by industry.

doubled from 1947 to 1965, in constant prices, and is expected to more than double again by 1985, in accordance with the outlook for production growth. Personal income per household, which rose by one-third in the postwar generation, may experience an increase of more than 50 percent by 1985. Most significant of all, from the point of view of urban growth and travel patterns, is the postwar and prospective upward shift of households to higher income levels (Fig. 3).

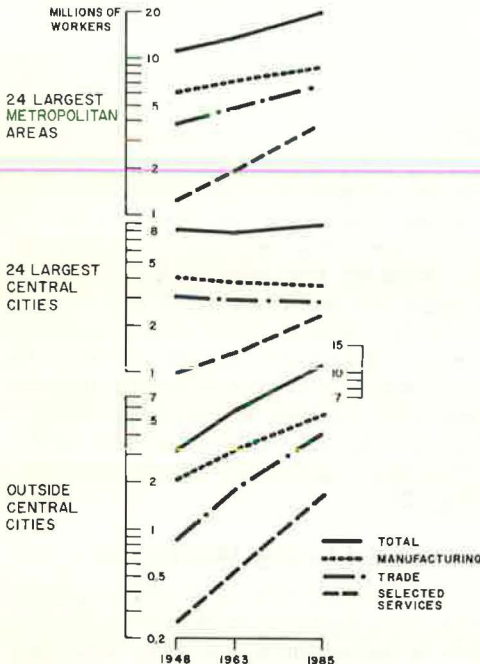


Figure 4. Employment in the 24 largest metropolitan areas in manufacturing, trade, and selected services.

Employment Structure

The prospective growth in population, labor force, and income levels will be accompanied by fundamental changes in the structure and intra-metropolitan area location of production and employment. For the economy as a whole, employment may be expected to grow by some two-fifths by 1985, a higher growth rate than that for population, in accordance with the larger share of 14 years old and over, and the expanding role of women in the labor force. More important, however, will be the anticipated change in the structure of production and employment, favoring the growth of government, business and personal service activities in comparison with agriculture, manufacturing and mining.

Intra-Metropolitan Area Employment Location

Growth and changing composition of metropolitan area employment have very basic implications for the intra-metropolitan area, central city-outside central city location of

employment and related residence location and urban travel patterns. The postwar experience has been one of a basic dichotomy in the experience of central cities and the outside central city portion of metropolitan areas. Virtually all of the postwar growth in metropolitan area employment has gone to the outside central city portion of the metropolitan areas. For the 24 largest metropolitan areas, accounting for more than half of all metropolitan area employment, there has been no rise in employment levels in the postwar period, as a significant decline in manufacturing and trade employment in central cities offset a substantial rise in service activity employment (Fig. 4). In contrast, the outside central city portions of metropolitan areas virtually doubled their level of employment, absorbing all of the postwar increase in manufacturing and trade, and raising their share of total metropolitan area employment from one-fourth in 1948, to two-fifths in 1963.

For the future, suppositions on the central city-outside central city location of employment may be drawn from (a) information on recent metropolitan area nonresidential construction activity which is a precursor of future employment location, (b) future economic sector composition of employment with their specific location characteristics, and (c) the location preference, technology and institutional factors prevailing in the postwar period. These factors suggest that more than four-fifths of an expected 50 percent increase in metropolitan area employment, between 1965 and 1985, will take place in the outside central city portion of metropolitan areas. Employment levels in central cities are expected to increase marginally, nevertheless, with the large expansion in service activities under way and anticipated.

Future growth and change in the economic sector composition of metropolitan area employment suggests that, though the postwar and prospective outward shift of manufacturing and trade employment will continue to dominate the intra-metropolitan area employment location structure, the large expected future increase in central city oriented service activity will support the economic viability of central city. Factors of location preference and technology will continue to favor the outside central city areas for the expansion of manufacturing and trade, and these directions are not likely to be much influenced by heroic measures to bring them back to central city.

Economic Growth and Urban Development, A New Turning Point

The prospective emergence, in the coming generation, of the outside central city suburbanization of economic activity as the predominant location of production and employment suggests a fundamental turning point in the 200-yr trend of industrialization and urbanization in the United States. In broad terms, the whole long-term process of industrialization and urbanization of the economy can be described as a process of interaction of (a) rising levels of income and productivity; (b) related changes in the composition of demand, favoring, first, manufactures, and later services; (c) changing structure of production, in line with demand, productivity and technology, favoring urban oriented manufacturing and service activity location; and (d) the consequent urbanization of the population to accommodate the changing structure of demand and production. This process also involved the improvement of the quality and upgrading of the economy, in terms of levels of productivity, as the growth and relative shift of manpower and capital from one industry and location to another was associated with advances in technology, manpower education and the rising level of investment in plant and equipment per worker.

THE EMERGING METROPOLITAN AREA ECONOMY

Since the early 1960's, the outside central city portion of metropolitan areas has become the dominant locus of the nation's population. For the future, the outside central city portion of metropolitan areas may double by 1985, absorbing almost all of the increment in the national population. This expectation is associated with the anticipated upward shift in income levels, the younger age of household heads, the more rapid growth in the Far West, and the related preference for lower residential density and single-family houses in a suburban setting. The notable increase in household heads in the 20 to 44-year-age group combined with the upward shift in income levels will

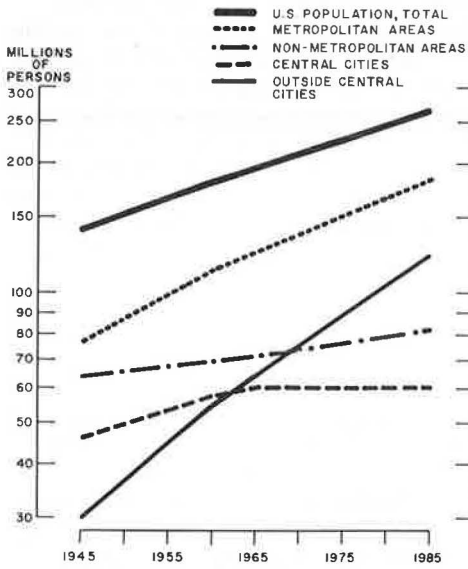


Figure 5. Urban population growth by central city-outside central city composition.

favor outside central city residence location. Conversely, the very limited growth in the over 45-year household head age group will limit the importance of the return to central city life phase in the 1965-85 period. Central cities whose overall population will not grow, despite a marginal increase in employment, will continue to have proportionately more of the very young, the old, and the poor, but the prospective change in central city employment structure will bring a new small flow of more affluent households to central city, while a share of lower income households will succeed in following manufacturing and trade jobs to the outside central city area. These developments will help revitalize central city economies, but special measures would be required, facilitating land-use changes, relocation of businesses and households, special financing, and redress for unrequited expenditures for central place functions benefiting the whole metropolitan area. Disadvantaged central city households will share less in the upward shift of income levels, and one-fifth of central city households may still be living below the poverty line in 1985 and have inadequate

access to jobs and housing. While pressures toward Negro central city separatism are understandable, gains for the disadvantaged will come easier if access can be facilitated to outside central city jobs and housing. The magnitude of metropolitan area growth over the coming generation suggests the possibility for resolving many key urban problems in the context of this prospective growth.

Metropolitan Area Growth and Suburbanization of Population

In the generation 1945-65, metropolitan area population grew by 48 million, a rise of two-thirds, and accounted for all but 5 percent of the 50 percent population increase in the postwar period. As of 1965, metropolitan areas, defined as urban concentrations with central cities of 50,000 population and over, made up some 64 percent of the total population. The metropolitan area share had been 54 percent a generation earlier in 1945. Even more significant than this urban metropolitan area population growth, however, was the emergence of the outside central city area as the dominant locus of metropolitan area population (Fig. 5).

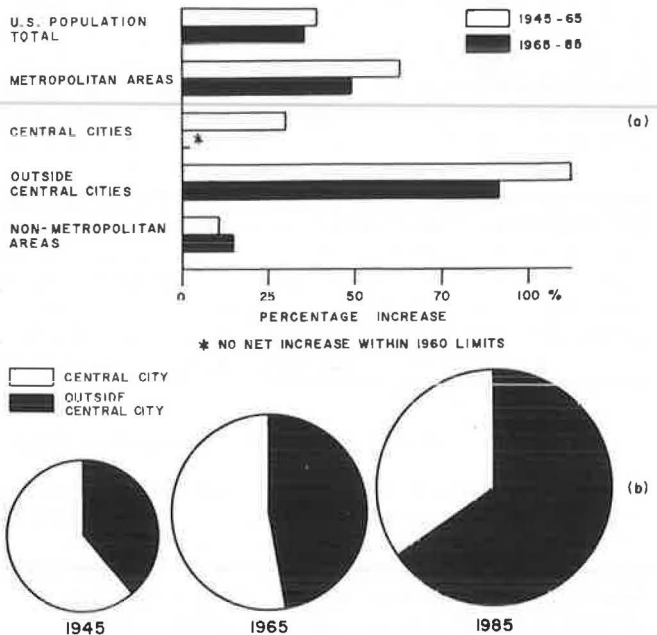


Figure 6. (a) Increase in urban population and (b) central city-outside central city composition of metropolitan area composition.

For the future, a population growth of 60 million in the outside central city area is expected to account for all of the anticipated 50 percent increase in metropolitan area population, and 85 percent of the projected 70 million rise in total U. S. population. While the metropolitan area share of total population would reach 70 percent by 1985, in comparison with 64 percent in 1965, the outside central city area population would make up two-thirds of that for metropolitan areas in 1985, in contrast to its one-half share in 1965 (Fig. 6). The population of the outside central city area, which more than doubled between 1945 and 1965, would almost double again by 1985. This pattern of outside central city population expansion would imply a continuation of the modest decline in the metropolitan area and outside central city area population growth rate experienced in the 1960-65 period in relation to the 1950-60 years. This overall pattern of no growth for central cities will be made up of continued marginal declines for central cities in the 24 metropolitan areas with a 1960 population of one million and over, offset by modest growth for central cities in metropolitan areas of less than one million.

Income Growth and Suburbanization

The broad upward shift of households to higher income levels in the postwar period was accompanied by an income growth related preference for lower residential density and outside central city living. By 1965, in line with the income growth related residence location preference, two-thirds of the affluent 46 percent of metropolitan area households having incomes of \$8,000 and over were living in the outside central city portion of metropolitan areas. Conversely, in 1965, 78 percent of the disadvantaged one-fifth of metropolitan area households having incomes of less than \$4,000 were living in central city. As a consequence of this pattern, households with incomes of less than \$4,000 in 1965 made up 30 percent of all central city households and 9 percent of all outside central city households. With respect to the upper income scale households with incomes of \$8,000 and over one-half of all outside central city households were in this category in 1965, in comparison with less than one-third of central city households.

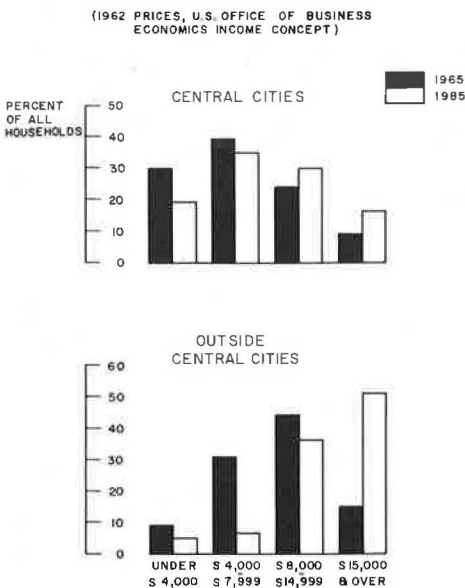


Figure 7. Central city-outside central city distribution of metropolitan area households by income level.

For the future, the anticipated growth and upward shift of households to higher income levels will also be accompanied by a further relative shift of households to outside central city residence location. In comparison with a one-third postwar growth in average household income, an expansion by more than half has been projected for the period 1965-85. In the context of the postwar experience, when central city population within 1950 boundaries showed no increase, the future expected upward shift in household income levels suggests that all of the 60 million increase in metropolitan area population, and more—some 18 million households, at least—will go to the outside central city portion of metropolitan areas. This prospect is complemented by the outlook for the growth in the number and share of household heads in the under-45-year age group with their related preference for single structures in a suburban setting. It is also supported by the perspective for continued relative shift of employment from central city (Fig. 7).

Viability of the Central City Economy

Despite the prospect for no growth in population and only marginal growth in employ-

ment, central city economies have a good potential for viability in view of the outlook for expansion of government, business and service activity in the context of an expanding national economy. Rising service activities in central city, offsetting an outflow of manufacturing and trade, will bring about a substantial change and upgrading of the central city labor force and the central city economy. The structure of households and their socioeconomic characteristics will change less, due to obstacles to mobility of disadvantaged central city population groups. Nevertheless, the potential for upgrading of jobs and income, and the change in economic function of central cities, together with the massive demolition and rehabilitation of structures that this would require, implies a possibility for substantial renovation of central city structure—in terms of public and private infrastructure facilities, as well as housing, including both slums and grey areas.

The achievement of this potential would require many things, including adaptation of land-use regulations to the changing needs of central cities, fiscal redress, and improved transport links with the expanding outside central city area.

NEW HORIZONS FOR URBAN TRAVEL PATTERNS AND URBAN TRAVEL DEMAND

A fundamental change in urban travel patterns, and an order of magnitude change in urban travel demand, may be expected in the coming generation. Urban travel patterns will shift from a central city funneling orientation to that of a dispersed outside central city network. Daily intra-metropolitan area person trips will double. These and other changes in the urban transport system will occur in the context of growth and structural change in the national economy, and related changes in the income, age and demand preferences of households, and the intra-metropolitan area location of employment and residence. Auto use in urban travel will become even more dominant, and the number of autos in use will double. Public transportation will be substantially improved with the introduction of many innovations and will continue to be an important part of the urban transportation system, even though public transit trips will increase only marginally. At least six new rapid-transit systems may be established, and existing systems will be substantially improved and expanded, but the total number of daily passengers would increase only marginally. Growth in public transportation and rapid-transit travel will be limited by the dispersed location of employment and residence and the preference for auto use. At the same time, one-fifth of all households in large central cities may have no auto, even in 1985, and for this group, the urban transportation system may provide inadequate access to jobs. Auto expenditures will take an increasing share of the consumer dollar, while public transit outlays will absorb a declining portion. Urban auto and highway needs will account for more than half of all outlays required to meet total transportation goals, including needs for rural highways, trucks, buses, trailers, rapid transit, new urban transportation systems, waterways and ships, oil pipelines, railroads, airways and planes, and air cushion vehicles.

Workers' Residence and Employment Location

The relationship between workers' place of work and place of residence is one of the main determinants of urban travel patterns and urban travel demand. In this sense, with the suburbanization of population and economic activity, important changes in workers' residence and employment location have occurred in the postwar period, and fundamental changes are in prospect over the next generation.

In 1960, with the forces leading to the postwar decentralization of jobs and residences in operation for more than a decade, the outside central city portion of metropolitan areas was already approaching the relative importance of central cities as the place of residence, but central cities continued to dominate as the principal place of work. In that year, 53 percent of all metropolitan area workers lived in central city, while 65 percent worked there (Fig. 8).

For the future, looking ahead to 1985, the outside central city portion of metropolitan areas will be the dominant place of workers' residence location and work location. In the period 1965-85, the outside central city area is expected to absorb all of the 60

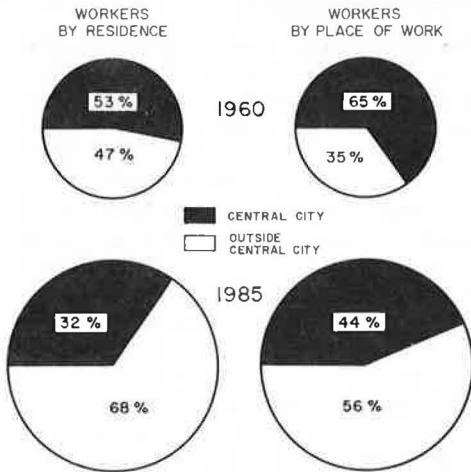


Figure 8. Workers' residence and place of work by metropolitan area.

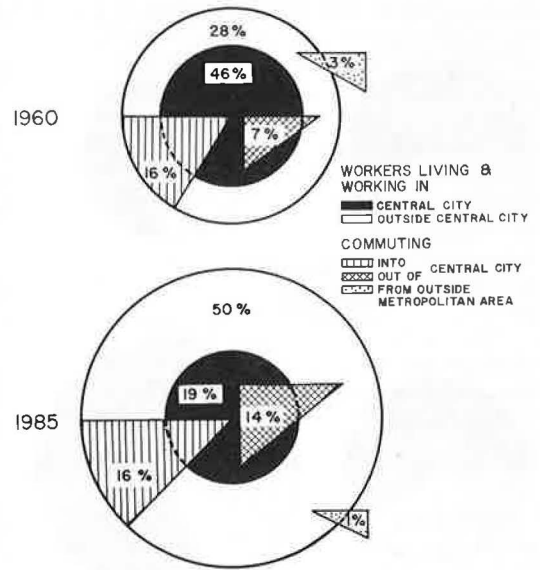


Figure 9. Urban travel patterns.

million increment in metropolitan area population, raising the share of workers residing in the outside central city area to more than two-thirds—twice that in central city. Central cities will fare somewhat better as a continuing center for workers' place of work, in view of the current and prospective expansion of government, business and personal service employment. Even so, with the continued outflow of manufacturing and trade, the outside central city area may be expected to be the place of work of more than half of all metropolitan manufacturing workers by 1985.

Workers' Commuting Patterns

The evolutionary change, postwar and prospective, in workers' residence and employment location signify the development of fundamentally new urban travel patterns. Based on these changes under way and in prospect, metropolitan area travel patterns may be expected to change from one in which the central city funneling function is dominant, to one in which dispersed travel from an outside central city residence to an outside central city place of work is the principal feature.

In 1960, most workers lived and worked in central city, and were supplemented each day by a margin of workers who commuted in from outside central city (Fig. 9). Only a small share of metropolitan area workers lived and worked outside of central city. In that year, 46 percent of all metropolitan workers lived and worked in central city, and were augmented each day by an additional 16 percent who commuted in from outside central city. Even then, however, some 28 percent of metropolitan area workers lived and worked outside of central city, and were complemented by some 7 percent of metropolitan area workers who commuted out daily from central city.

Looking ahead to 1985, the outside central city portion of metropolitan areas will be the principal place of metropolitan area residence and work, with new commuting patterns, from an outside central city residence to an outside central city work location, dominating, and obsolescing prevailing concepts. At least half of all metropolitan area workers will be living and working outside of central city. These outside central city workers will be supplemented by a daily flow of a margin of workers commuting out from central city, who will match the margin of workers flowing into central city. Only one-fifth of all metropolitan area workers will live and work in central city.

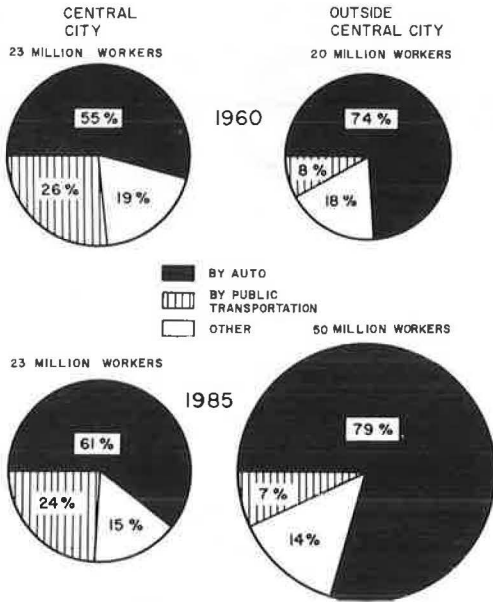


Figure 10. Workers' means of transportation.

shift of households to higher income levels, in 1985 are likely to have no automobile, and for this group, the problem of providing transportation access to take advantage of expanding job opportunities outside of central city is likely to be acute (Fig. 11).

Travel Demand

In the framework of expanding metropolitan area economies, expected to experience a two-thirds population increase between 1960 and 1985, urban transportation demand, in terms of intra-metropolitan daily vehicle-miles, is expected to much more than double by 1985. This anticipated burgeoning of urban transportation demand reflects a combination of (a) expected growth in the number of daily person trips as incomes rise and the labor force participation rate grows, (b) an enhanced auto travel mode preference, (c) a related increase in auto driver trips per person as the number of autos per household increases, (d) a rise in daily vehicle-miles per auto as urbanized land areas are extended and residence and employment locations are dispersed, and (e) an increase in the level of daily vehicle-miles per person arising from the foregoing factors (Fig. 12).

Travel Mode Preference

These prospective fundamental changes in metropolitan area travel patterns are closely associated with travel mode preferences by central city-outside central city characteristics, as revealed in the 1960 census and in recent behavioral surveys. In effect, while the journey to work by auto is presently favored by more than half of all workers residing in central city and some three-fourths of all workers living outside of central city, the shift of population and jobs to the outside central city portion of metropolitan areas, with their associated higher levels of income, may be expected to increase the overall preference for autos as the dominant travel mode (Fig. 10).

Transport Needs of Disadvantaged Households

The prospective decentralization of jobs is likely to work hardship on those disadvantaged households living in central cities and having inadequate means of transportation to facilitate access to jobs. Even in the framework of a prospective broad upward

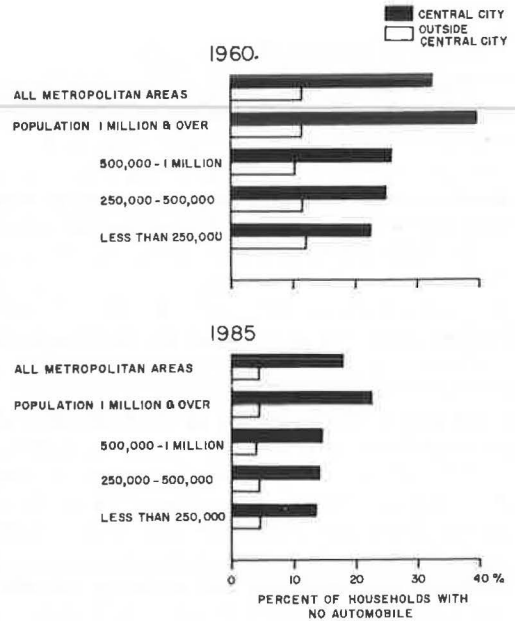


Figure 11. Households with no automobiles.

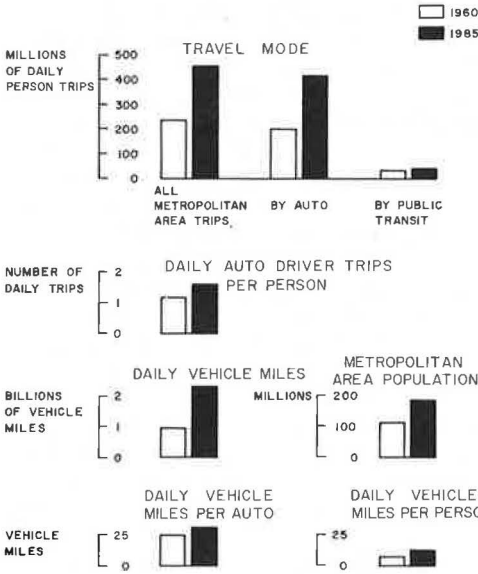


Figure 12. Intra-metropolitan area travel demand.

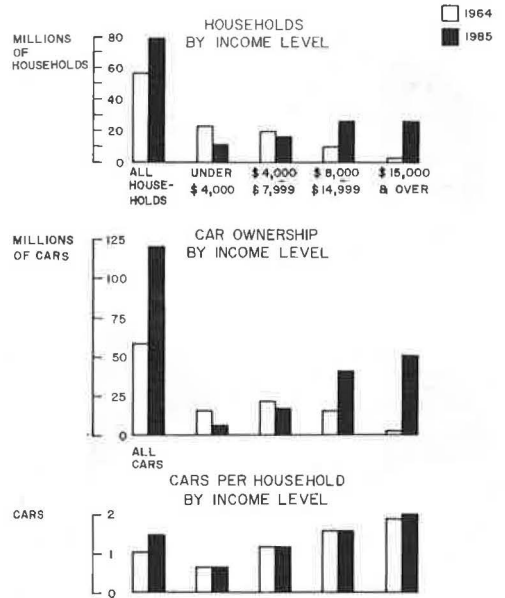


Figure 13. Car ownership and households.

Expanding Demand for Automobiles

In the perspective for urban travel demand, the outlook for expanded auto travel mode preference and the growth in the number of autos per household, by one-third in the course of one generation with a consequent doubling of the auto stock, has a key role. This outlook for expanded auto use is closely related to emerging urban growth patterns—growth and change in central city-outside central city residence location, rising household income levels, the younger age of household heads, and regional differences in growth perspectives.

In 1964, auto use varied radically by household income levels. Households in the nation as a whole had an average of 1.1 autos, but the 42 percent of households with incomes of less than \$4,000 had 27 percent of the autos in use—an average of 0.7 autos per household. In contrast, households with incomes of \$15,000 and over had an average of 1.9 autos per household (Fig. 13). The less than one-fifth of households in the \$8,000 to \$14,999 income class, and the more than two-fifths of households in the under \$4,000 group, had the same share of autos, 27 percent.

Looking ahead to 1985, the growth in households and their upward shift to higher income levels will bring a doubling of autos in use. This will occur even if the 1964 rate of cars per household, by income levels, prevails in 1985. Households for the nation as a whole are expected to increase from 56 million in 1964, to 79 million in 1985, with a corresponding shift from one-fifth with incomes of \$8,000 and more in 1964, to two-thirds in 1985. Assuming the same 1964 rate of autos per household, by specific income level, the number of autos per household would increase

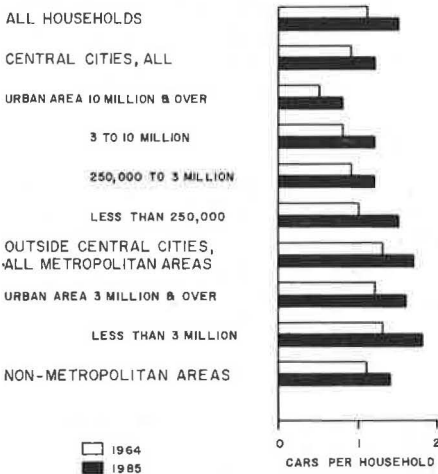


Figure 14. Cars per household.

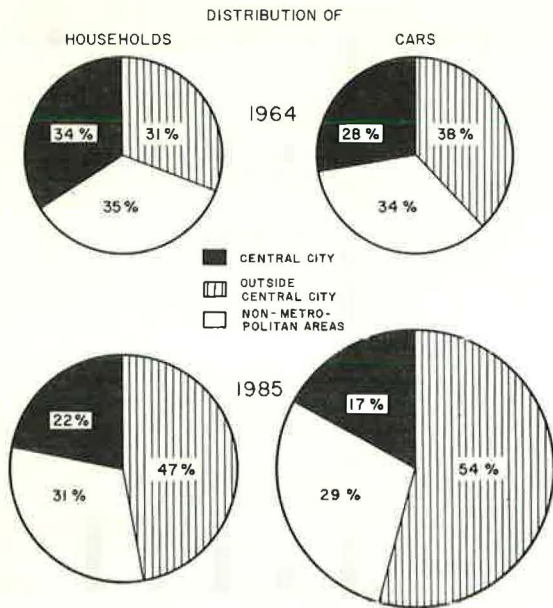


Figure 15. Cars and households.

from 1.1 in 1964, to 1.5 in 1985. The stock of autos in use would double. Households with incomes of \$8,000 and over would increase their share of total autos in use from one-third in 1964, to three-fourths in 1985. This prognosis of a doubling of autos in use by 1985 is in line with other prognoses using other methods (Fig. 14).

Looking ahead to 1985, the growth and shift of households to the outside central city portion of metropolitan areas will bring about a substantial rise in auto use and a fundamental change in urban travel patterns and travel demand. The outside central city area may be expected to hold 47 percent of the households with 54 percent of the autos in use (Fig. 15). The corresponding central city share of households and autos would fall to 22 percent and 17 percent, respectively. Such a transformation will change basically the nature of urban travel patterns and travel demand.

Role of Public Transportation

Rapid transit and commuter railroad systems provided the means for the journey to work for 6 percent of all metropolitan area workers in 1960. The number of mass transit passengers has been falling since the end of World War II, as a consequence of the rise in household incomes, the suburbanization of the population, the expanding preference for auto use, the relative neglect of existing transit systems, and limited development of new ones. Nevertheless, for large central cities, those in metropolitan areas with a 1960 population of one million or more, rapid transit accommodated 16 percent of the workers in their journey to work and represented an important element of the urban transportation system.

Recent studies indicate a declining future relative role for rapid transit. The present study, with its indications of growth and change in residence and employment location, fundamental change in urban travel patterns, and basic expansion of travel demand, also suggests a limited though important future role for rapid transit systems. In the coming generation, potential travel densities, justifying the installation of new rapid transit systems, are likely to develop in only a handful of the largest cities.

URBAN TRANSPORT NEEDS

The demand for urban freeway-type travel facilities will dominate the expansion of the urban transport system, with a need for a more than doubling of route-miles of urban freeway by 1985, over and above that scheduled with the completion of the urban portion of the Interstate System by 1972. This need will flow from the new urban travel patterns, the enlarged travel demand, the increased auto travel mode preference, and a one-third increase in the urbanized land area.

The Need for Urban Freeways

Order of magnitude requirements for route-miles of urban freeway needed may be crudely estimated on the basis of the relationship of autos in use with freeway needs, as revealed in current urban transportation studies by metropolitan area size class and by central city-outside central city composition. A recent study suggests a need for

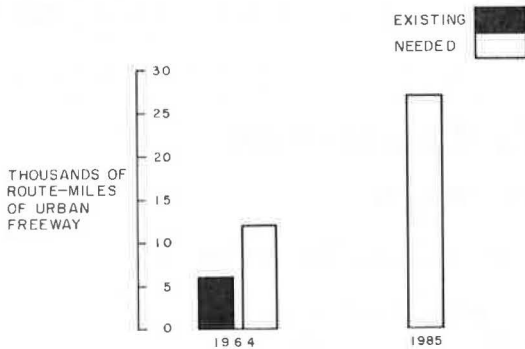


Figure 16. Urban Freeways.

2.5 to 3.5 route-miles of urban freeway per 10,000 autos, with the smaller requirements for large central cities, and the larger requirements for the smaller outside central city portion of metropolitan areas. Applying this criterion to autos in use in 1964 by metropolitan area central city-outside central city composition results in a hypothetical estimate of 12,000 miles of urban freeway presently needed—or roughly that called for by the time of the scheduled completion of the urban portion of the Interstate Highway System in 1972—about twice that existing in 1964, reflecting a substantial unmet present need (Fig. 16). Applying this same rule of thumb to the projected level of autos in use in 1985, by metropolitan area central city-outside central city size class, suggests a

hypothetical need by 1985 for twice the route-miles of urban freeways scheduled for 1972.

Need for an Enlarged, Dispersed, Improved, Innovative Metropolitan Area Transportation System

While urban freeway type travel will be the dominant urban transportation mode of the future, more freeways alone would not resolve some of the key urgent transportation problems of the expanding metropolitan area economies. Trips would be substantially lengthened for the doubled population of the portion of metropolitan areas outside central cities. Multiple freeway lanes would pyramid. There would be a need to provide means to improve job accessibility, facilitate a wider choice in housing, and ease travel to education parks, while enhancing safety and paying due respect to aesthetics. The future transportation system must also aid the physical integration of the spreading metropolitan areas through improved spatial mobility. There is the important need to aid the viability of the central city through better freeway linkages.

All of these elements suggest the need for innovation in the expansion of the urban transport system. A key element must include devices for semi-automated travel over urban freeway type systems. Such an innovative urban transport system must be made up of radials and successive circumferentials to provide a flexible, multi-directional urban transport pattern. The system must provide speedier and more convenient travel over an expanded urbanized area.

ACKNOWLEDGMENTS

I wish to express appreciation to William W. Seifert, Associate Dean of the M. I. T. School of Engineering and Director of Project TRANSPORT, Siegfried Breuning, Director, M. I. T. Highway Transportation Program, as well as John Howard, Lloyd Rodwin, and Aaron Fleisher, M. I. T. Dept. of City and Regional Planning, for encouragement of the research effort.

Irving Silver, with his companion report, *Urban Population, Households and Housing: Postwar Characteristics and Growth, Perspectives to 1985*, contributed much to the study. Other participants included Juan Francisco Baez and David Mann, all M. I. T. graduate students. This study was supported by a General Motors grant to M. I. T. for highway transportation research.

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