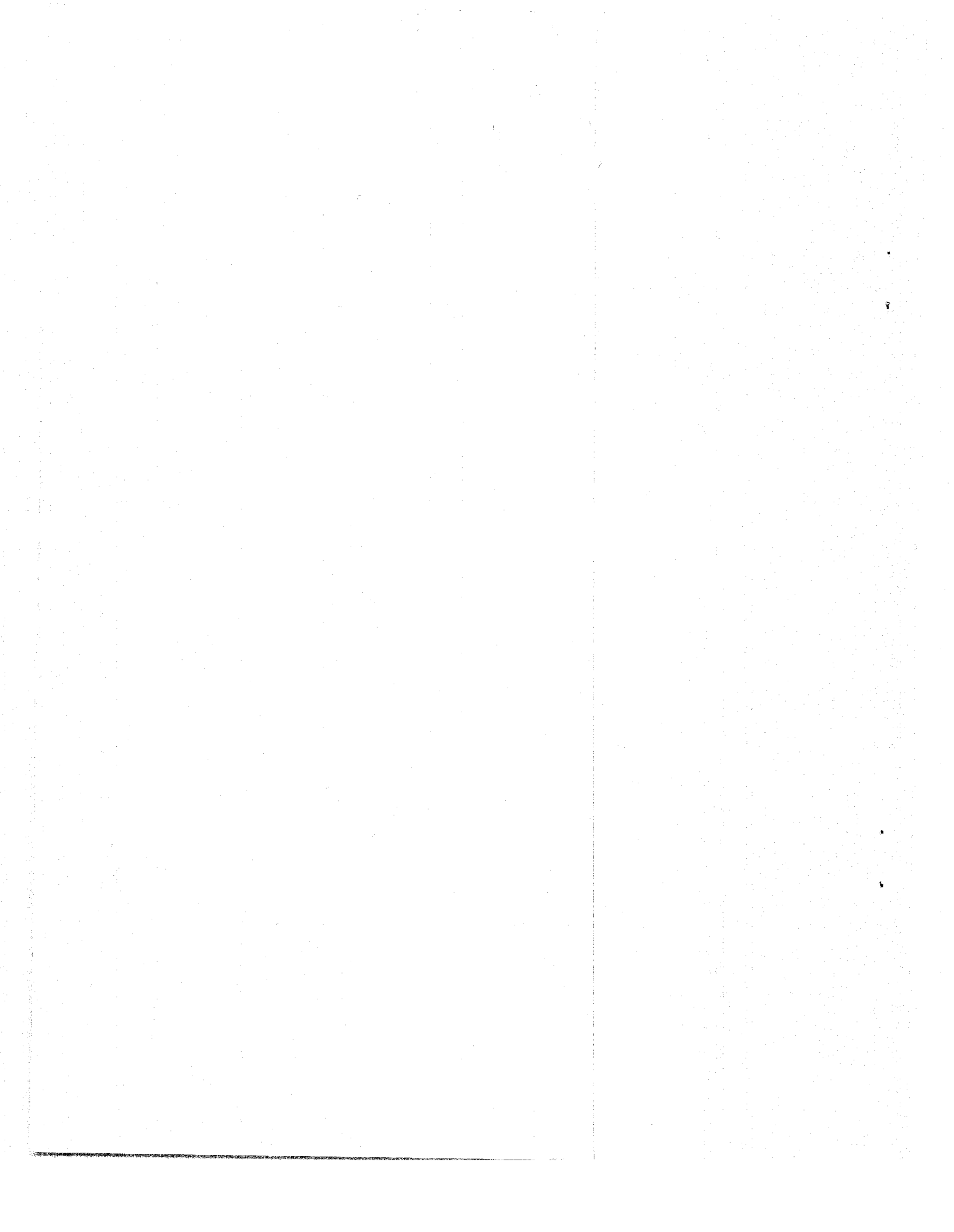


BENEFITS
OF
INTERSTATE
HIGHWAYS



BENEFITS OF INTERSTATE HIGHWAYS
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SUMMARY OF REPORT ON
BENEFITS OF THE HIGHWAY PROGRAM

Interstate and other highways influence the growth of the economy by improving mobility for economic and social activities. Benefits of the Interstate System include those received by people while using highways and benefits accruing to people and communities indirectly, as a consequence of highway use. These user and nonuser benefits sometimes overlap, as is noted below.

USER BENEFITS

Benefits accruing to Interstate travelers are substantial and will more than pay for the investment. By completion in the late 1970's, total cost of the program is estimated to be \$70 billion. Total user benefits accruing from the program are estimated to be \$107 billion even if we assume no values for automobile driver and passenger time savings. This total benefit is comprised of \$45.8 billion for operating cost savings, \$15.8 for accident cost savings, and \$45.8 for commercial vehicle time savings valued at \$5.56 per truck hour. If we assume that car driver-passenger time has a modest value of \$1.50 per hour, total user benefits amount to \$274 billion. If we value time saved at \$3.00 per man-hour for passenger car occupants, a figure found by competent study to represent the value they actually place on their time, and also equivalent to the nationwide average wage, about \$438 billion total benefits would be returned to Interstate users by the time the system is complete.

Travel Time

The Interstate program has achieved an average 10 percent reduction in travel time between cities. Travel speeds in selected corridors averaged 36 miles per hour in 1956; in 1969, the average speed was 41.7 miles per hour in corridors without Interstate routes and 46.4 miles per hour in corridors with Interstate routes. The 4.7 mile per hour difference can be attributed to the Interstate. If the travel on the Interstate System were to be held throughout the program period to the lower speeds prevailing on the routes which the completed sections replaced, the added travel time would cost \$212 billion at \$1.50 per man-hour for passenger car occupants, and \$5.56 per vehicle hour for commercial vehicles.

When the Interstate corridors are completed, the average speed excluding any stops on these corridors will increase to between 50 and 60 miles per hour. Analysis of 47 intercity corridors, amounting to over 3545 miles in 37 States, showed time savings of 16 to 50 percent where the corridor was substantially completed. Of 32 rural corridors, 17 indicated time savings of 35 percent or more; maximum savings of 50 percent occur along three corridors. Urban corridors analyzed also showed substantial time savings, for example, 60 percent on I-15 south from Salt Lake City, Utah.

Operating costs

Savings in vehicle operating costs on Interstate highways result from removing impediments to constant speeds such as steep grades, friction from entering and leaving traffic, traffic signals and stop signs. For example, the cost of one stop and return to speed for a single 20-ton truck combination is over 20 cents.

Increases in vehicle operating speed typical of travel on the Interstate System, while reducing time costs, does tend to increase operating costs. However, these increases in costs are more than offset by the savings just referred to -- from fewer stop signs and signals.

Accident reduction

During the program period accident savings resulted because travel occurred on Interstate rather than formerly traveled-routes are estimated at \$15.8 billion. This is based on \$475 per accident avoided for property damage, \$1,800 per injury avoided, and \$100,000 per fatality avoided. The attendant pain and suffering avoided cannot be estimated. Accident studies on 7,000 miles of highway in 39 States since 1955 show significant reductions in accident rates on Interstate routes:

	<u>Rural</u>	<u>Urban</u>
Property damage accidents	38%	48%
Injury accidents	39	37
Fatal accidents	43	15

Traffic in the Corridor

Opening Interstate sections in a corridor reduces congestion on the existing, formerly-traveled route. In 12 of the 16 corridors analyzed traffic dropped by 50 percent or more and remained at these levels for up to 10 years.

Goods movement

Highway ton miles of freight have increased rapidly with expansion of Interstate highways -- by over 60 percent during the 10-year period since 1958. Interstate highways permit truck operators to realize considerable benefit from direct reduction in distribution costs. University researchers have also called attention to additional benefits that goods distributors can realize by reorganizing or relocating plants or warehouses to take advantage of the Interstate System; this additional saving can amount to an extra 12 percent over and beyond the reduction in transport costs.

GENERAL ECONOMIC AND COMMUNITY BENEFITS

Highways improve opportunities for work and leisure activities. These new opportunities frequently are more beneficial than the saving in time or money which Interstate travel affords. The benefits of Interstate highways -- to industry and commerce, to people in their nonwork activities, to communities through environmental improvement, and as a stimulus for growth centers -- can be arrayed and described separately to help understand these effects. To a large extent, these benefits extend beyond those received by highway users. For example, the aesthetic benefit a local community received from the parklike influence of a well landscaped highway can amount to a benefit beyond those which accrue to highway users in savings

of vehicle operating cost, time, and accidents. Generally, however, these benefits are not commensurable and thus cannot be added together or to estimates of highway user benefits. For example, Interstate highways tend to lower transportation costs of business firms by reducing vehicle expenses and employee time (e.g., time of truck drivers). This can result in higher profits for firms. These effects typically are reflected in enhanced land values at the site of the affected business. All of these effects are important, but it would be counting many benefits twice to regard the sum of vehicle and time savings, business profits, and land values as a measure of highway effect or benefit.

The highway concept has changed significantly in recent years in terms of purpose, scope, and complexity - from basically an engineering endeavor to a powerful tool for social change. In addition to the traditional goal of increased mobility highway construction is being used to help those who are displaced achieve acceptable housing, to renew blighted urban areas by providing improved structures alongside or within the right of way, to foster economic growth, and to improve aesthetics with plantings and other landscaping. The need to preserve and enhance environmental values has included recognition of the importance of having individuals and groups and local governments participate fully in highway planning, location, and construction.

Land use and value

Interstate highways influence the way land is used or developed. Where other conditions necessary for development are present, highways can serve as catalysts for economic development.

Land values provide an indicator of the economic potential of land. The improved accessibility of highways increases the number of potential uses for land nearby. This increase in the supply of available land tends to be offset by the increased demand for land made accessible by the highway. The highway effect on land typically is an increase in demand and in price. For example, the North Central Expressway from Dallas to Richardson, Texas, 15 miles from downtown Dallas, was accompanied by an increase in the price of vacant land in both Dallas and Richardson. Land values, in constant dollars, increased nearly 200 percent in Dallas and 500 percent in Richardson during the 8-year study period.

Industrial and commercial effects

Highways provide new sites for development and benefit employers and employees by broadening the labor and job markets and reducing commuter travel time. For example, analysis of manufacturing employment changes in 212 cities from 1958 to 1963 showed that cities located near the Interstate System added manufacturing jobs slightly faster than nonfreeway cities -- 19 new jobs per thousand people versus 16. In regions where travel on regular highways is especially impeded by heavy traffic, frequent towns, and numerous hills and curves, Interstate cities are gaining in manufacturing employment about twice as fast as nonfreeway cities.

Employment opportunities provided by modern highways include the increase in the choice of jobs brought within a worker's commuting area, the ease workers have in locating appropriate employment, and the flexibility afforded for workers with irregular hours, seasons, and places of employment. Modern highways also increase alternative opportunities available to shoppers. Many central business districts of major cities have been overshadowed by trade growth in suburban areas, particularly where downtown traffic congestion exists. To some extent, retail trade activities in central business districts have been replaced by recreational, institutional, specialty retail, and office space uses.

Nonwork opportunities

Residential neighborhoods can benefit from the diversion of traffic from streets to Interstate highways. With reduced traffic in residential areas, people are given additional mobility and a better opportunity to shop for goods and services at neighborhood stores.

Although residential areas are affected adversely by congested city streets, there is little general dissatisfaction with locations near Interstate highways. Near Portland, Oregon, a study of several subdivisions built adjacent to Interstate highways noted a tendency for the higher priced, custom-built houses to be built adjacent to the freeway -- for the commanding view, as a buffer against encroaching nonresidential uses, etc. Over 80 percent of 155 owners questioned regarded the freeway proximity as an advantage.

Opportunities for community change

New concepts and procedures are helping make highways compatible with surrounding areas. For example, displacement from highway right of way is being used as an opportunity to upgrade housing and community services. In 1969, supplemental payments for the higher cost of housing after relocation were made to about 20 percent of the families displaced. These averaged \$2300 for owner-occupants and \$1500 for renters. Community services and environment are being improved, in some instances, by jointly developing community facilities with highway construction.

Interstate highways also can have a significant beneficial impact in reducing air and noise pollution in urban areas. These highways reduce unnecessary travel through downtown areas where existing noise and air pollution levels are high, and they reduce pollution and noise effects of stop-and-go traffic on city streets. For example, an automobile emits about .42 pounds of carbon monoxide per vehicle mile in central business district driving but only about .11 pounds on expressways.

New towns and economic growth

Interstate highways lend themselves to encouraging growth centers away from existing large cities in new towns or in areas of the country desiring economic development. Highway transportation is also emphasized as a remedy for under-developed areas. The Connecticut Turnpike, for example, has apparently served one of the primary purposes intended -- to improve the local economy. Manufacturing employment in the Turnpike area increased 27 percent between 1956 and 1962, compared to no change or a decline elsewhere in Connecticut.

USER BENEFITS FROM THE HIGHWAY PROGRAM

The benefits to the American traveler from the Interstate system will more than pay for the \$70 billion investment. From 1956 to 1979 when the system is expected to be completed a total savings of \$107 billion will accrue or \$37 billion more than the current estimates of what the 42,500 mile system will cost when its completed. The reduction in starts, stops, etc. means less fuel and oil consumption, less tire wear and maintenance. Over the 23 year span this adds up to \$45.8 billion. The Interstate system is almost twice as safe as the older roads. This means fewer accidents, fewer repair bills, hospital costs, etc. These savings are figured at \$15.8 billion for the 1956-1979 period. The Interstate also is a great time saver and time is valuable. Time saved for trucks is worth \$5.56 an hour, and over the 23 year span, this adds up to another \$45.8 billion, making a total savings of \$107 billion.

This computation gave no value to time saved by passenger car occupants. If such savings were valued at a modest \$1.50 per man-hour for passenger car occupants and \$5.56 per truck hour for the years 1956-1979, they would amount to \$212 billion for time savings alone. When this amount is added to the operating cost and accident savings already mentioned this modest value placed on automobile driver-passenger time amounts to a total benefit of \$274 billion.

If the time saved by car passenger and drivers were computed at \$3.00 per hour, a figure found by competent study to represent the value they actually place on their time, and also equivalent to the nationwide average wage, and a value of savings per truck hour of \$5.56 were used, about \$438 billion would be returned to Interstate users by the time the system is complete.

TRAVEL TIME

The Interstate program has achieved an average 10 percent reduction in travel time between cities. Based on comparisons of 1956 and 1969 bus schedules and travel times provided in Rand McNally Road Atlases with and without Interstate routes, reductions averaging 10 percent were found on corridors which followed Interstate routes. Average travel speeds in intercity corridors with Interstate routes increased from 35.6 mph in 1956 to 46.4 mph in 1969 or 23 percent. For intercity corridors without Interstate routes the increase was from 36.1 mph to 41.7 mph, or an increase of 13.5 percent. Thus, improvements in vehicles and regular upgrading of non-Interstate highways provided speed increases of 9.8 percent, with only the difference of 4.7 mph attributed to the Interstate. When the Interstate corridors are completed the average speed excluding any stops on these corridors will increase to the range of 50-60 mph, resulting in even greater savings in time.

NATIONAL HIGHWAY PROGRAM

On long trips, a distance of about 365 miles could be safely traveled during a 10-hour day by an average driver in 1956. In 1969 he could accomplish this in 8 hours via Interstate type routes and add another 100 miles by driving 10 hours.

Even greater time savings will result as the remaining sections of the intercity routes are constructed to Interstate standards. Analysis of 47 intercity corridors reported by 37 State highway departments amounting to over 3545 miles where the entire corridor mileage was substantially completed showed time savings of from 16 percent to 50 percent. Thirty-two of the corridors with complete before and after data were substantially rural with only short urban sections through smaller cities and towns. Of these 32 sections, 17 indicated time savings of 35 percent or more; maximum savings of 50 percent occur along

a 12-mile I-81 corridor across western Maryland near Hagerstown, a 7.1-mile section of I-95 southwest of Providence, Rhode Island, and a 42.5-mile section of I-40 from Knoxville, Tennessee, to the west.

Relatively low time savings occur along only two of the corridors analyzed -- 18 percent on an 18-mile section of I-95 paralleling U.S. 301 in North Carolina, and 16 percent on a 9-mile section of I-26 paralleling U.S. 176 between Columbia and Charleston, South Carolina.

All three of the urban corridors showed savings of about 50 percent or more--I-91 (19 miles north from New Haven, Connecticut), 49 percent; I-95 (5 miles northeast from downtown Providence, Rhode Island), 50 percent; and I-15 (26.6 miles south from Salt Lake City, Utah), 60 percent. In about half the cases, travel time savings on the order of 10 percent were experienced on the older parallel routes due to the reduction in traffic and congestion.

The following values were used in computing time savings:

1. \$5.56 per truck hour (and buses) in all estimates.
2. \$1.50 per driver and passenger hour (\$3.00 per passenger vehicle hour) in the \$273.5 billion total benefit estimate.
3. \$3.00 per driver and passenger hour (\$6.00 per passenger vehicle hour) in the \$438 billion total benefit estimate.
4. Zero value of time saved by drivers and passengers in cars in the \$107 billion total benefit estimate.
5. For passenger cars, an occupancy of 2 persons per vehicle.
6. Average speeds for the program period would increase from 35 mph to 50 mph in rural areas, and from 15 mph to 40 mph in urban areas.

OPERATING COSTS

Savings in operating costs, resulted from the elimination or bypassing of impediments to constant speeds such as traffic signals, grades and curves. Since travel intensity is somewhat greater for the Nation-- average daily vehicle-miles per mile of 10,210 for the U.S. versus 7,594 for 12 States--somewhat greater savings could be claimed. These data from the Interstate System Traveled-way Study are recorded for all Interstate mileage in the State on a section-by-section basis and provide details concerning the characteristics of both completed and traveled-way sections serving the Interstate traffic in the corridor. In 1960, relatively little mileage was completed and open to traffic--656 miles or 7.9 percent in the 12 sample States compared to over 4755 miles or 10 percent for the Nation. By 1966, completed sections totaled 3,064 miles or 36.7 percent in the 12 States and 17,830 miles or 41.9 percent for the Nation.

Traffic signals cause a share of approaching vehicles to slow appreciably or come to a stop and then accelerate to running speed. The cost of a single 20-ton truck combination stopping from 50 mph and accelerating back to speed is estimated at over 20 cents for one stop, or nearly \$84,000 per year for 1,000 stops per day. In the 12 States sampled, vehicles traveling the Interstate faced 582 fewer traffic signals in 1966 than in 1960. Compared to 1960, grades of 3 percent or more had been reduced by 120 miles and 35,711 access points causing side friction from entering and leaving traffic had been eliminated.

ACCIDENT REDUCTION

A total of \$15.8 billion was estimated for the saving in accident costs during the program period. This is based on the additional costs of fatalities, injuries, and property damage which would result if travel on the Interstate System had resulted in accidents at the same rates as on the formerly traveled routes. The comparative rates result from the Interstate Accident Study ²/conducted on 7,000 miles of highway -- existing traveled-way before Interstate construction, existing highways after Interstate construction, and completed Interstate -- in 39 States, beginning 1955.

Indicated reductions in corridor accident rates for the study period are:

	<u>Rural</u>	<u>Urban</u>
Property damage accidents	38.5%	47.9%
Injury accidents	39.4%	37.5%
Fatal accidents	43.4%	14.7%

TRAFFIC IN THE CORRIDOR

When the new Interstate sections in a corridor are opened to traffic, congestion on the existing, formerly-traveled route is diminished by traffic reductions of as much as 50 percent. In 16 corridors where State highway department continuous automatic traffic recorders (ATR) on traveled-way and completed Interstate routes were paired, there was some decrease in traffic volume on the existing road following opening of the Interstate. In 12 of the 16 corridors traffic dropped by 50 percent or more and remained at these levels for up to 10 years. Traffic increases were steady in the corridor before opening, 3 to 5 percent annually. After opening, traffic increases on the Interstate accelerated to annual rates of 10 percent and more for as much as 10 years after opening. See Figure 1.

GOODS MOVEMENT

Figure 2 shows that between 1958 and 1968 highway ton-miles have increased by 60 percent, nearly twice the 36 percent increase for rail. Since the value of goods movement to the shipper is a function of both amount shipped and travel time, the trends in the travel bill by mode provide an implicit indication of the benefits of transportation. Highway revenue has increased by 86 percent compared to only 20 percent for rail.

While the Interstate System has expanded the range of the truck transportation market, railroads continue to increase their share of the long distance freight movements. Data from the shippers survey of the 1963 and 1967 Censuses of Transportation show that for the 7 shipper groups accounting for two-thirds of all highway shipments by manufacturers (meat and dairy; canned fruits and vegetables; basic chemicals and plastics; drugs, synthetics and other chemical; petroleum and products; stone, clay and glass; and primary iron and steel products), the rail share has increased for 6 of the 7 shipper groups for distances beyond 1,000 miles.

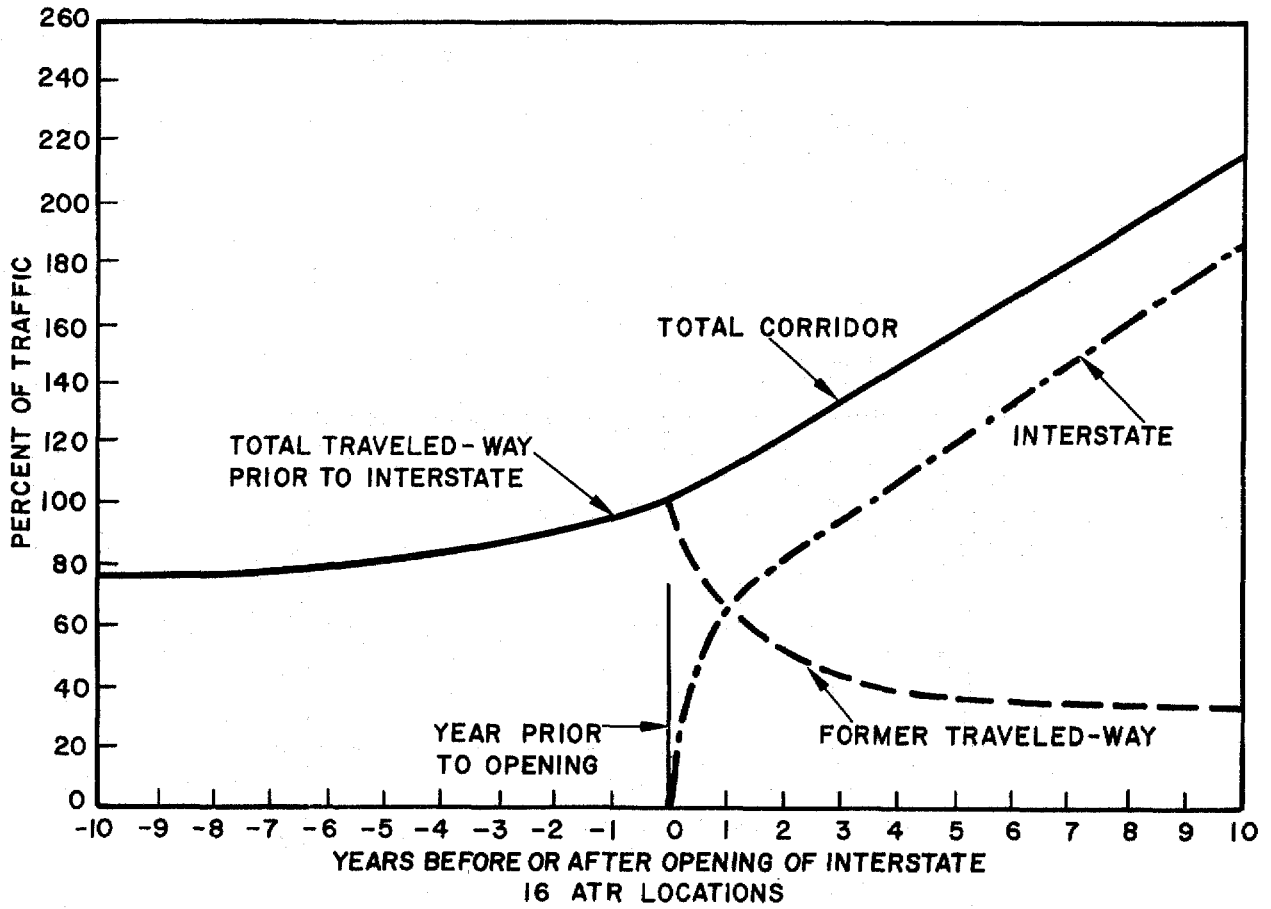


FIGURE 1: TRAFFIC GROWTH IN 16 INTERSTATE CORRIDORS BEFORE AND AFTER THE INTERSTATE ROUTE IS OPENED TO TRAFFIC

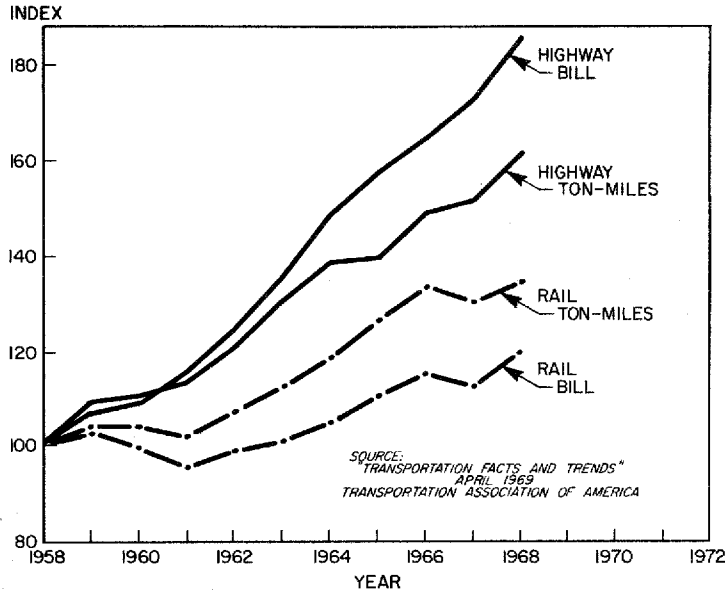


FIGURE 2 TRENDS IN TON-MILES OF HIGHWAY AND RAIL FREIGHT TRANSPORTED AND THE RELATED TRANSPORTATION BILL

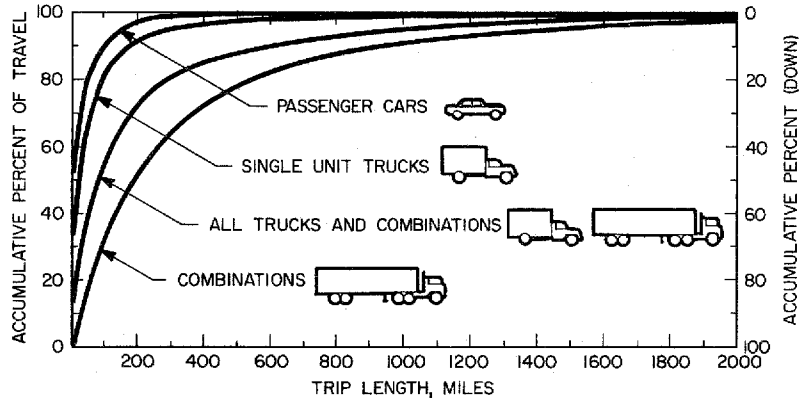


FIGURE 3 ACCUMULATIVE PERCENTAGE OF TRAVEL FROM TRIPS OF INCREASING LENGTH FOR PASSENGER CARS, SINGLE UNIT TRUCKS AND COMBINATIONS.

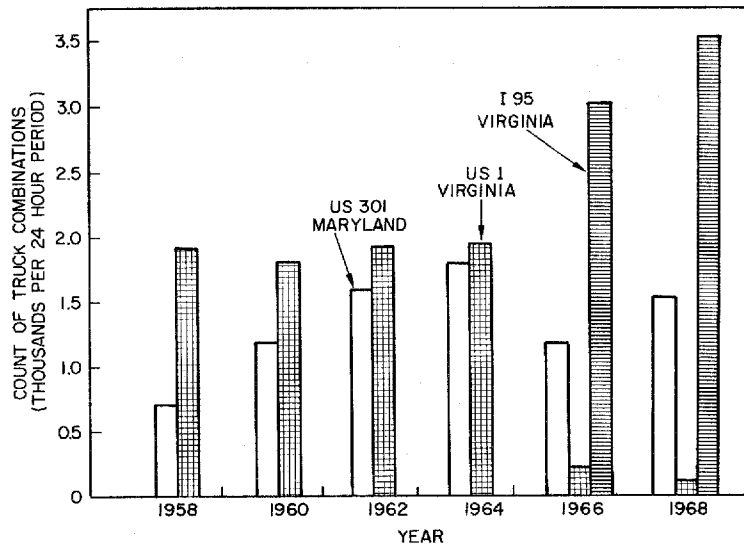


FIGURE 4 TRUCK COMBINATIONS PER 24 HOUR PERIOD

The comparison of trip length distributions in figure 3 shows the great potential use of Interstate routes by the large truck combinations with about half their travel resulting from trips of 200 miles or more. At an average speed of 50 miles per hour, a 400 mile journey can be accomplished in 8 hours, compared to nearly 12 hours at 30 to 35 miles per hour. With several hundred stops, starts, steep grades, and the side friction of intersections and access points, the added operating cost on some of the older congested intercity routes is a significant amount. Thus, the intercity freight hauler receives appreciable benefits from both reduced travel time and operating costs.

Figure 4 shows the prompt response of the operators of truck combinations to improved highway facilities after I-95 from Richmond, Virginia, was connected to I-495, the Capital Beltway around Washington, D.C., in 1964. Comparing the counts of truck combinations in 1964 on US 1, (the old four-lane undivided route with many steep grades, sharp curves, crossroads, and strip commercial development) with counts for US 301 in Maryland (a four-lane divided route with no control of access and a toll bridge) it is seen that volumes were nearly equal at 1,995 and 1,800 respectively. By 1966, the I-95 count exceeded 3,000; that along U.S. 1 dropped below 200 and to 1,250 along U.S. 301 in Maryland as the highway freight movers took advantage of the more economical route.

Truck use of highways aids productivity in at least two ways: by expanding market areas and by lowering distribution costs. In goods movement, the reduction of unit transport costs through improved highways is a direct benefit to shippers. Whether the benefits of goods movement savings are passed on to consumers or are partially absorbed by shippers or their employees, significant savings are realized by the national economy.

Northwestern University researchers describe two types of benefits from lowering transport costs. First, it provides "direct" benefits by reducing the costs of distributing the previously established volume of products of existing manufacturing facilities. Second, it permits an industry to shift its production and distribution process toward a greater emphasis on transportation, thereby permitting the spatial reorganization or centralization of some processes which previously had to be spatially spread out, for example. The Northwestern researchers estimated that if industries took full advantage of "reorganization" opportunities afforded by an improved transport system they could save an extra 12 percent over and above the direct benefit entailed in the initial reduction in transport costs. 3/

Other evidence of improved efficiency of goods movement through greatly improved highway systems may be seen in truck data from Illinois and Texas, for example. The average payload weight for all tractor-semi-trailer combinations using rural primary highways in Illinois increased from 22,800 pounds in 1957 to 28,200 pounds in 1967, or a percentage increase of nearly 36 percent over the 10 year period. An econometric analysis performed at Northwestern University in 1965 ^{4/} found that a 10 percent increase in average shipping weight is associated with a 7 percent reduction in average shipping costs. Applying this finding to the Illinois truck data results in an estimated 25 percent reduction in transport costs for all tractor-semi-trailer combination users of Illinois' rural primary highways over the 10 year period. These are direct benefits. Including the additional indirect or "reorganization" benefits realizable if the industries involved take advantage of spatial and other reorganization opportunities afforded by an improved highway system, provides total savings of 28 percent in 1967 over 1957 (25 + .12 of 25). These are the benefits accruing to firms as highway users and the benefits they realize from locating plant sites more advantageously, often called nonuser effects.

GENERAL ECONOMIC AND COMMUNITY BENEFITS

Advances in highway service have been closely associated with the growth of the American economy. Interstate and other improved highways expand opportunities for economic and social activities by increasing the number of alternative sites where it is feasible to work, shop, vacation, etc. Better transportation increases the options open to people using the system.

Highway transportation goals become more ambitious as time goes by. These goals are no longer limited to simply achieving a transportation purpose such as moving people or goods or "getting the farmer out of the mud." The goals now include better qualities in our style of living and our environment. More and more, highway resources are becoming a positive force for attaining both community and transportation goals.

The effect highways can have in achieving purposes not directly related to transportation has been recognized for several years. The beneficial effect of highways on land use and value, on industry and commerce, and on nonwork opportunities, for example, have received considerable attention. Such matters as residential dislocation, community disruption, noise, and fumes have also received considerable attention. As a solution, highway locations and designs are sought which are more compatible with the surrounding environment. In some instances, the quality of the environment is actually enhanced through the provision of community facilities jointly developed with the highway.

LAND USE, ACCESSIBILITY, AND VALUE

Highways, particularly Interstate highways, influence the way land is used or developed. Where other conditions necessary for development are present, highways can serve as catalysts for economic development. By making large amounts of land available for development, highways often encourage development of areas formerly considered too remote.

The need for this new land for development is suggested by a University of Washington study. The University analysts concluded that intensive land development will occur near the interchanges of large metropolitan areas within a few years after the Interstate System is completed.

Current experience at interchange areas of Interstate highways shows how attractive these areas are for development. Near interchanges in urban areas, land typically sells for a significantly higher price than comparable land away from the interchange areas.

Just how land values are affected by the improved accessibility of highways or other transportation facilities has received considerable attention. For example, in Washington, D.C., one minute less of driving time from the central business district has been found to be the equivalent of \$65 in the price of houses (in the \$8000 to \$30,000 price range). Houses 3 miles from the central business district typically have values about \$400 higher than comparable houses 4 miles away, and houses 7 rather than 8 miles away enjoy a premium of about \$200. 5/

Land value changes provide a fairly good indicator of the change in economic potential of land, whether the change is associated with investment in a park, an airport, a subway station, or a highway. Improved accessibility of transportation facilities typically increases the possible uses for land nearby. This improvement in transportation making more land available may reduce land values generally. However, this increased supply of land may be offset by the increased demand of people in the enlarged area served by the improved highway.

Land value experience near improved highways generally supports the view that the highway effect on urban land tends to be an increase in demand and in price. For example, the North Central Expressway from Dallas to Richardson, Texas, 15 miles from downtown Dallas, was accompanied by an increase in the price of vacant land in both Dallas and Richardson. Land values, in constant dollars, increased nearly 200 percent in Dallas and 500 percent in Richardson during the 8 year study period. Land in Richardson became much more competitive with land in downtown Dallas. 6/

Urban land values

A number of studies of land values along major highways have been made, most of them varying as to type of highway improvement, size of community, study methods, etc. Analysis of 183 individual study segments shows that median annual increases in land prices along highways ranged from 6 to nearly 18 percent in the 5 to 10 year study period. Gains in value were much more common than losses; for the highway study segments analyzed, 94 percent gained and 6 percent lost. Also, the amount of the gains in areas influenced by the highway generally exceeded gains in areas remote from the highway influence.

The experience which shows that modern highways are associated with value enhancement of nearby land also shows that industrial land tends to be enhanced more than land in other uses. Apparently the potential of industrial land is more likely to be improved by a new or improved highway than is the case for other uses. Commercial and unimproved parcels tend to be benefitted less than industrial land but more than residential land.

<u>Land use when highway was built</u>	<u>Median annual percentage gain in value during study period</u>
Industrial	18
Unimproved	12
Commercial	10
Residential	8

Highway effects on land values over a period of time have received some attention. Over a 19-year period, sales of 190 parcels of land along Interstate 35 near Temple, Texas and in a control area away from the highway indicate that the highway has had a significant impact in that area.

	<u>Price per Acre</u> (in constant dollars)	
	<u>Study area</u>	<u>Control area</u>
Before period (1943-48)	\$.73	\$ 82
After period (1955-61)	3055	167
Percentage change	4085	104

Within the study area, properties abutting the new highway were enhanced more in value than nonabutting properties. Thus, from \$73 per acre before highway construction, per acre values in the study area rose to about \$3400 for abutting properties and \$2400 for nonabutting properties. 7/

Interchange land values

Land values near highway interchanges have often shown substantial changes. At interchange areas along Interstate 94 in Michigan, land parcels that were analyzed experienced a 200 percent gain over the value before highway construction. Parcels purchased for service stations gained over 500 percent. During the 5-year period of the study, value gains ranged from 15 to 35 percent in the control area. 8/ Along the Capital Beltway in Virginia, areas with access to a major radial highway and the Beltway have maintained high land values. In Maryland, even a parcel without any public access but near an interchange of two limited access highways experienced a significant gain in value (from \$2000 to \$3500 per acre) along with construction of the Capital Beltway.

Rural land value

Values of rural land depend upon a myriad of economic and social factors, including highway improvements available to provide transportation to rural areas. While there are a number of indications of the benefits highways provide for rural areas - easier marketing, more intensive

farming operations, and increased educational, social, and cultural opportunities - one of the best indicators of rural highway benefits is the value of the affected land.

The value of good roads to farming and to agricultural land has been recognized fairly generally. Farm land located on hard surfaced roads typically sells for more than comparable land on gravel or dirt roads.

For farm land effects of Interstate highways, a recent study of farm land along Interstate 10 in Chamber County, Texas provides information. This study found properties abutting the highway typically increased in value by \$66 dollars per acre. ⁹ Properties not abutting the highway experienced no change significantly different from the control area, located some distance away. The change in constant 1947-49 prices per acre during the 19-year period of the study (1947 through 1965) can be summarized as follows:

	<u>Properties abutting the highway</u>	<u>Control Area</u>
Before period	\$ 66	\$ 54
After period	295	187
Percentage change	347	246

Some of the gains in value of property abutting the highway were associated with a change to nonfarm use of these parcels.

What effect Interstate highways have on farm land which continues to be used as farm land has received some attention. Some indication of this is provided by the right-of-way case studies conducted in all the Continental States. Land used for farming before right-of-way acquisition and continuing in that use at least until the remainder sold has experienced a gain in value in over 80 percent of the cases. These cases involve both Interstate and other highways. In general, more remainder parcels along Interstate routes experience large increases in value than parcels along other highways. Thus, of the remainder parcels which sold for 500 percent or more of the value before the highway was constructed,

- 17 percent were along Interstate highways,
- 14 percent were along Federal-aid Primary highways, and
- 3 percent were along Federal-aid Secondary highways.

Highway influence on tax valuations

The acquisition of property for highway use ordinarily has the immediate effect of removing some property from the tax rolls. However, longer range effects of highway construction on tax revenues have proven to be generally favorable. Highway improvements usually have resulted

in the development of vacant and other unproductive land. Thus, the loss of some property from the tax rolls is frequently offset by increased assessments on property benefitted by highway improvement or construction.

Highways vary in their effect on tax rolls. Where land values are lowered, tax assessments could be affected adversely. Also, in intensively developed areas, acquisition of property for right-of-way could cause relocation of business or residences elsewhere, if the taxing jurisdiction's boundaries are restricted and if little vacant land is available. However, tax roll effects of right-of-way acquisition even in fully developed areas may be offset by renewal and redevelopment and more intensive development associated with the highway. This tendency for tax rolls to be enhanced by development is being strengthened by joint development which helps assure that the transportation facilities lend themselves to development serving community goals.

INDUSTRIAL AND COMMERCIAL EFFECTS

Highways are vital to the well-being of local and regional economies. Highways stimulate employment opportunities by providing new and more efficient sites for industrial development and benefit both employers and employees by broadening the labor market and job market and reducing commuter travel time.

Highways and industrial location

Factors influencing plant location decisions include availability of highways and other modes of transportation, labor supply, and proximity to markets and raw materials. Among these, good highway facilities rank high. For example, a recent Business Week Survey^{10/} asked the question "If your company were selecting a new plant site, which of the following would be of importance to you in selecting the specific area or site?" The top five factors out of the 29 listed are shown in the accompanying table, with "trucking", which is closely related to highway location, ranking first.

<u>Area of Interest</u>	<u>Percentage of Respondents Indicating Significant Importance</u>
Trucking	75%
Reasonable cost of property	67
Reasonable or low taxes	65
Ample area for expansion	63
Favorable climate	62

The reasons for this recognition of the importance of a highway location in industrial site selection are fairly obvious. Benefits which firms derive from highway locations include availability of additional space for expansion, visible exposure to the motoring public as a form of advertising, and greater access to labor, raw materials, and consumer markets.

Manufacturing growth

Additional evidence that Interstate highways are associated with manufacturing growth was provided by a recent comparison of manufacturing growth from 1958 to 1963 in cities near Interstate highways and in comparable cities located elsewhere.^{11/} A sample of 212 cities (106 city pairs) was studied. These represented 40 States; all but a few cities were between 10,000 and 50,000 in population. Growth was expressed in terms of new jobs per thousand people. When all 106 city pairs were combined in a Nationwide total, freeway city employment grew only slightly faster than that in nonfreeway cities--19 new jobs per thousand people versus 16. However, in regions of dense population and uneven terrain, freeway cities added employment significantly faster than cities removed from the freeway influence.

	<u>Jobs Added per Thousand People</u>	
	<u>Freeway Cities</u>	<u>Nonfreeway Cities</u>

Cities in the fast growing Southeast, East Midwest, and Pacific Northwest Regions	43	23
Cities served by airlines in the Southeast, East Midwest, Pacific Northwest, plus those in the slow-growing Northeast	27	2

These findings indicate that intercity freeways are associated with manufacturing growth in regions where travel on regular highways is especially impeded by heavy traffic, frequent towns, and numerous hills and curves; that is, in regions with dense population and topographic irregularities.

Employment opportunities

Of the benefits of modern highways accruing to employers, the greater ease in recruiting and retaining a suitable supply of labor deserves emphasis. Interstate highways typically enlarge the area from which workers commute to employment. For example, around Washington, D.C., Maryland workers commuting by the Capital Beltway have become part of the Virginia industrial work force. And a similar use of the Beltway in the opposite direction has been noted - that is, Maryland employers draw workers from Virginia.

When viewed from the employee's standpoint, the same highway benefit to employers in extending their labor market may be seen as extending workers' employment opportunities over a greater geographical area. Thus, improved highways increase employment opportunities in two ways - by stimulating economic activity through industrial location decisions, and by extending the geographical areas within commuting distance through a reduction in travel time. More employment opportunities increase the

likelihood that individuals will be able to find jobs at a level corresponding to their capabilities. Among the benefits are gains in productivity and earnings as well as increased job satisfaction.

Central business districts

Modern highways increase alternative opportunities, including opportunities available to shoppers. Highways are generally advantageous to commercial establishments in suburban areas. Many central business districts of major cities have been overshadowed by growth in suburban areas, particularly where traffic congestion exists. The problems with the decline of general retail trade in the central business districts have been mitigated to a large extent by an increased use of downtown areas for other uses such as recreational, institutional, or specialty type retail and especially for office space.

There is some evidence that, as the Interstate System nears completion in urban areas, the relative advantage of a downtown business location will improve. A study conducted in Washington, D.C. ^{12/} analyzing delivery experience of (1) a retail department store chain, (2) a dairy, (3) a concrete distributor, and (4) a household goods mover, concluded that at the 1967 stage of completion of the Interstate System, the accessibility to a dispersion of retail outlets and consumers from a downtown location was about equal to the accessibility from a location on the Capital Beltway in the surrounding suburbs. However, completion of the Interstate System would give an estimated 20 percent accessibility advantage (expressed in vehicle minutes) to the downtown location.

Bypass routes

Considerable attention has been focused on the economic and social effects of highway bypass or traffic relief routes. The importance of highway facilities which permit through travelers to avoid local streets becomes especially apparent from consideration of the destinations of travelers along major highways. For smaller towns, half or more of the traffic approaching passes on through the town. Permitting this through traffic to avoid downtown streets can provide benefits both for the local residents and for those passing through in terms of reduced traffic congestion and increased safety.

Experience with bypass routes reveals little consistent relationship between traffic changes in bypassed areas and business activity. Adverse effects are sometimes experienced by gas, food, and lodging establishments, particularly in smaller towns. Other businesses often experience gains, apparently because removing through travelers from downtown areas eases shopping there. A comparison of 23 bypassed towns with control towns showed that 14 bypassed towns had smaller gains in retail sales than control towns; in 9 bypassed towns, retail sales gains exceeded those in control towns. In another analysis, of 37 bypassed towns, in 18 States, bypassed towns with gains in retail sales outnumbered those with losses 33 to 4. Traffic declined along most of the bypassed routes.

NONWORK OPPORTUNITIES

The value of mobility "can be reckoned in options per minute or options per dollar where the option is a functional activity such as shopping or working..." ^{13/} Using such a measure of effectiveness for transportation systems, Interstate highways rank high. Highway mobility increases options for residences, recreation, education, health, and cultural activities.

Residential neighborhood effects

Traffic congestion on local residential streets generally has a negative impact on residential neighborhoods. Noise, vibration, air pollution, and safety are some of the significant factors in this relationship.

Interstate highways can enhance urban neighborhoods as a place to live by reducing some of the congestion on city streets, which are rarely designed to handle heavy automobile and truck traffic. With reduced traffic flows in residential areas, people are given additional mobility and a better opportunity to shop for goods and services at neighborhood stores. Thus, there are advantages to both the residents and the commercial enterprises serving these residents.

Although congested city streets have an undesirable effect on residential areas, there appears to be little general dissatisfaction with living near modern, well designed and well located Interstate highways, perhaps because Interstate highways are often well-landscaped and well-fenced. Their superior design reduces the noise, air pollution, and aesthetic problems associated with congested local streets. Also, builders and planners, frequently provide sufficient set-back space to make the property appealing to home owners.

Several studies have recorded favorable responses of residents near freeways, particularly because of the improved accessibility to work. Other advantages include the privacy afforded, protection from encroachment, and creation of a more attractive area.

The Capital Beltway (I-495) in Virginia illustrates some of the benefits an Interstate highway can have on the location of residential development. ^{14/} The improved accessibility provided by the Beltway in the northern Virginia region deterred development from leapfrogging out along the major radial highways and from clustering around the outlying communities, where development had previously occurred. Instead, apartments and other development occurred along the beltway and in the wedges formed by the radial highways inside. From 1964, when the beltway was completed, until 1966, about 30 percent (over 3,000) of the apartment units built in Fairfax County were built within one and one-half miles of the Beltway.

Highways as land use buffers

Near Portland, Oregon, a study of several subdivisions built adjacent to Interstate highways indicates a tendency for the higher-priced, custom-built houses to be built adjacent to the freeway. ^{15/} Reasons given were that "the freeway not only creates a commanding view but also acts as a buffer against undesirable encroachment ... In one subdivision, 91 percent

of the owners stated that they had no serious objections to the proximity of the freeway and the other 9 percent objected...to noise created by hot rod drivers and heavy trucks at night." A resume of the results of the owner attitude survey is given below:

<u>Question</u>	<u>Answer</u>	
	<u>Yes</u>	<u>No</u>
Apprehensive of freeway before buying?	18	137
Price reduced because of freeway?	0	155
Similar homes available farther away?	134	21
Buy here or in similar location again?	140	15
Now consider freeway an advantage?	128	27

In Baltimore, the Urban Design Concept Team suggests that residential neighborhoods can benefit by properly located and designed highway improvements which provide a buffer against land uses incompatible with the neighborhood. They argue that in the area under discussion, "incompatible land uses penetrate the residential neighborhoods at various points; there is a need for a clear demarcation of the neighborhood edges." Recent advances in highway design permit the facility to serve as a buffer against unwanted encroachment of land uses but do not necessarily act as a barrier to mobility.

Recent experience and progress in air rights usage and other joint development and multiple use projects allow Interstate highways to become more compatible with residential neighborhoods and even to enhance the quality of these areas. In a number of instances, housing and necessary neighborhood services have been developed jointly with highways and have improved or restored neighborhoods and increased their potential for housing people in a satisfactory manner.

Highways and recreation

Highways help in meeting the increased demand for recreation resulting from increases in leisure time and in income. Highways provide benefits both for those seeking recreation and for businesses supplying recreational goods and services.

In addition to providing access to recreational sites, highways themselves are a source of outdoor recreation. Thus, unlike other trips which are a means to accomplishing some purpose, recreation trips are sometimes made for the pleasure of the trip itself. The Outdoor Recreation Resources Review Commission reports that, as outdoor recreation, driving for pleasure is nearly as popular as swimming and walking.

Opportunities for recreation

The improved accessibility provided by Interstate highways increases the options people have for recreation by enlarging the area they can reach without increasing their travel time. This potential increase in opportunities for recreation is in fact being realized, both for long distance vacation travel and for local recreational trips. For example, recreational travel has been increasing faster than other travel and vacation trips are becoming longer.

Travel distances reported for vacation trips vary, apparently depending on such things as time available, income, geographic area, and type of highway available. An Outdoor Recreation Resources Review Commission (ORRRC) study in 1965 found the round-trip distances driven on 10-day vacations to be about 1300 miles. A sample of motorists traveling Interstate 70 in Kansas found the round-trip distances to be 2400 miles. The American Automobile Association (AAA) reports that round-trip distances driven by members on 16-day vacations average nearly 2500 miles.

Distances traveled on vacations appear to be increasing. Driver interview studies of three parallel routes in Kansas--I-70, U.S. 40, and Kansas Route 18--in 1960 and 1966, before and after completion of a substantial share of the mileage between Kansas City and Denver, showed that trips of over 200 miles increased from 14 percent to 60 percent of the total. ^{16/} The AAA reports that average distances of 16-day vacation round trips by members were

2150 miles in 1959,
2200 miles in 1963
2400 miles in 1966, and
2480 miles in 1968.

The lines on Figure 5 show the enlarged area made accessible by these lengthening trips. The expanded area which a traveler from Chicago has for recreation in the West seems especially significant.

This increase of about 15 percent in vacation trip lengths actually requires slightly less travel time as the Interstate System becomes more nearly completed. The 2480 mile trip in 1968 required about 5.5 days compared with nearly 6 days for the 2150 mile trip in 1959. This assumes daily travel distances of 500 miles on Interstate highways and 350 on other highways, (maximum safe distances suggested by the AAA;) it takes account of the fact that the Interstate was about 15 percent completed in 1959 and 64 percent completed in 1968. ^{14/}

The map also depicts the expanded area which the improved accessibility of Interstate Highways afford for 2-day trips, for example, on weekends. From 350 miles per day on nonfreeway facilities, the Interstate System extends the distance which it is safe to travel in one day to 500 miles. This increase in travel distance which the AAA considers safe amounts to about 40 percent. It enlarges the area that can be reached for recreation or other activities by over 100 percent.

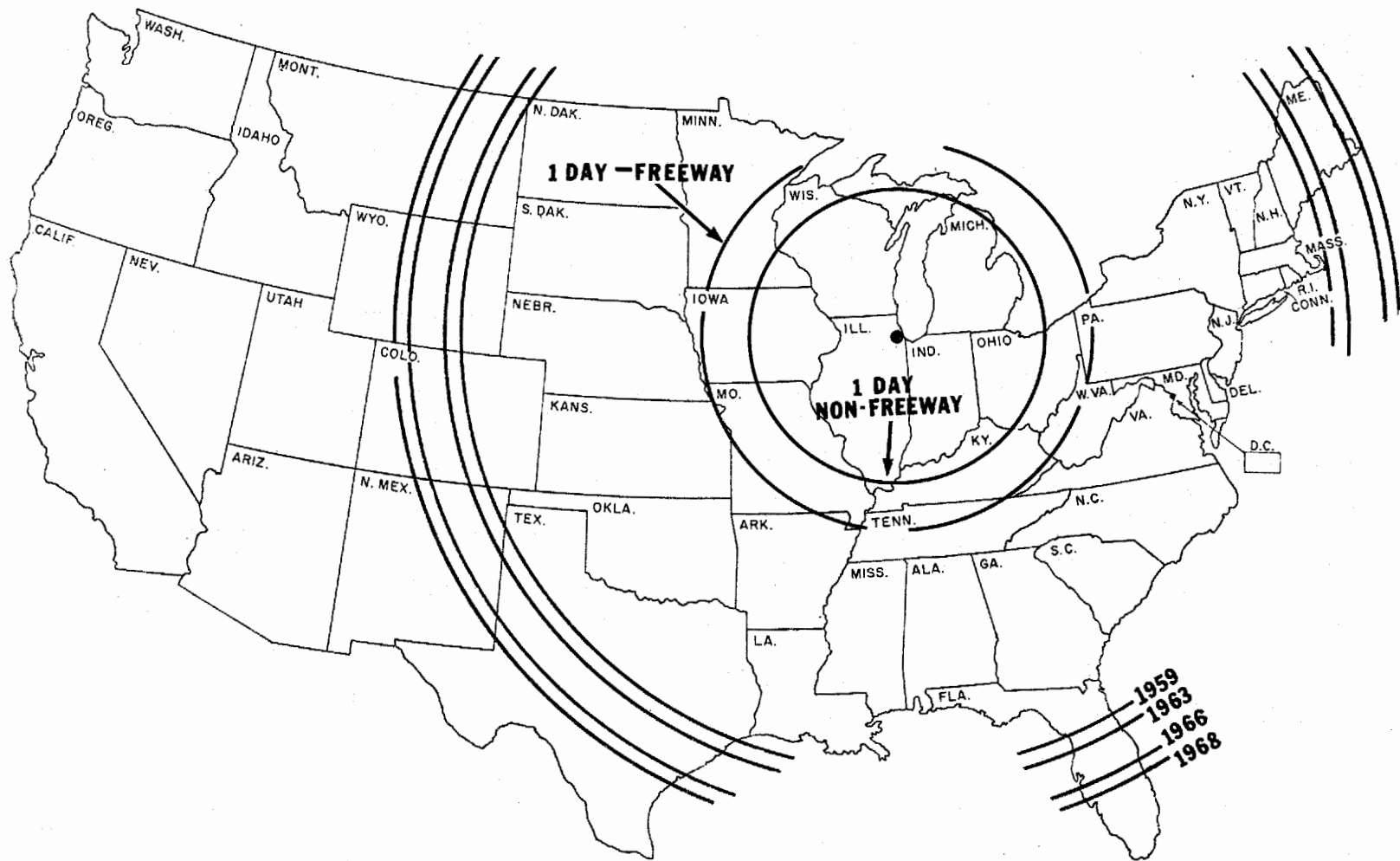


Figure 5 - Expanding opportunities for recreational travel associated with the development of the Interstate Highway System from the Chicago area. The large circles show the enlarged areas made accessible by the 16-day vacation round trips taken by members of the American Automobile Association; these distances increased from 2150 miles in 1959 to 2480 in 1968. The smaller circles show the enlarged area made accessible by Interstate highways (now 70 percent complete), assuming 500 miles as a safe daily travel distance on Interstate and 350 miles on noninterstate routes, as suggested by the AAA.

Along with opportunities for recreation in an expanding geographic area, Interstate highways affect opportunities within the existing area. For example, along the Maryland side of the Capital Beltway, golf courses and parks are used by more Virginia residents than before the Beltway was constructed.

The use of the Interstate by long-distance travelers is demonstrated by the replies of motorists interviewed at Interstate and noninterstate rest areas. For example, at Interstate rest areas, only 2 percent of the trips were shorter than 250 miles, while at noninterstate areas 23 percent were in this range. 17

Rest area effects

Interstate highways permit travelers to increase their average speed and travel distances for recreation or other purposes. These highways also benefit those choosing more leisurely travel, for example, by means of 2500 rest areas. The large number of travelers stopping and the 20 minutes they average at rest stops indicate that the benefits being derived are substantial. The imputed cost for rest areas approximates 3 cents or less per visitor, the capital and maintenance costs of a typical rest area divided by the visitors anticipated during the life of the rest area. While the benefit derived from each visitor's 20-minute stop is difficult to evaluate precisely, it undoubtedly exceeds the 3 cent cost.

Rest areas have benefits beyond those accruing to travelers visiting these areas. Rest stops increase safety, a benefit for all highway travelers and for the economy. In addition, rest areas may benefit local business if travelers increase their local consumption because the rest stops prolong the time they spend in an area.

Recreational travel industries

Spending for recreation has been increasing at a fast pace, often resulting in increased employment in areas that lack other employment opportunities. The significance that tourist travel may have for employment is suggested by a U.S. Chamber of Commerce estimate that cash which a community receives from 24 tourists per day is the equivalent of a factory with an annual payroll of \$100,000. At least half the States count travel among their three major sources of revenue.

In addition to industries serving travelers directly, recreational spending affects a number of industries indirectly. Several of these, such as camping, boating, and sporting equipment and summer homes, show exceptionally fast rates of growth.

Health, education and cultural benefits

Highways have historically been associated with major advancements in public education in rural areas. Improved highways have enabled elementary and secondary schools to consolidate into larger units, with consequent upgrading of teaching and physical facilities. Recently, highways have been a factor in the utilization of the smaller state colleges established to supplement major universities. By putting these schools within commuting distance of most areas, a realistic opportunity for higher education can be given for all who desire it.

A parallel development has occurred in the field of vocational education. In the Appalachian region, manpower centers offering specialized job training have been situated by major highways in order to make them accessible to the surrounding areas. Since most trainees find it necessary to remain at their place of residence or employment while learning their new skills, the highway system has been essential to the success of these programs.

Highways have also made possible the increased level of medical care for rural residents. In those areas unable to support adequate medical facilities, easy access to regional hospitals has been the only means to proper medical care, and such hospitals are feasible only by serving a large geographic area. Preventive care and testing may be available through mobile health units. The Interstate system also makes it possible for rural residents to travel to urban areas to obtain whatever specialized care they may need.

For many handicapped or elderly persons, the automobile is the only mode of travel flexible enough for their special needs. The available evidence indicates that a large portion of handicapped persons use automobiles regularly, frequently as passengers rather than drivers. Recognizing the dependence of such persons on highway travel, most states are designing rest areas for easier use by the handicapped. Among the most important features of this design are ramps, lower wash basins, wider doors and stalls and reachable phones.

With increasing urbanization there is evidence that highways may contribute to health in an indirect but very significant way. Public Health Service scientists who have studied the relationships between recreation travel and mental health believe that such travel tends to reduce tension and therefore improves mental health. This can come about through the change in environment and release from job pressures and urban stress.

The general accessibility that highways provide within a metropolitan area can be of importance to organizations and institutions. For example, membership in 36 churches located near interchanges of the Capital Beltway increased considerably faster than other churches. Spokesmen for these churches felt proximity to the Beltway had had a favorable effect.

OPPORTUNITIES FOR COMMUNITY CHANGE

Highways with heavy traffic volumes can have undesirable effects. Benefits associated with Interstate highways have been more noticeable than for highways of lower design. However, these highways with heavy traffic volumes require careful planning to avoid community disruption.

To help make highways compatible with surrounding areas, new concepts and procedures are being developed and put into effect. Highway planning is emphasizing several ways of using highways to generate positive community benefits. Such techniques as relocation assistance, joint development, and urban transportation planning are helping communities substitute benefits for what might otherwise be harmful effects from highway noise, pollution, congestion, and dislocation from the right of way.

Relocation assistance

Considerable progress has been made in minimizing the hardships that families and individuals experience due to dislocation from highway right of way. Most of the families and businesses that have been relocated have remained in the affected community or adjacent area. Many owners have taken the opportunity of displacement to upgrade their properties. However, "just compensation" for property taken has not in the past covered all costs of relocation and many of those relocating have suffered financially.

Some of these extra costs of relocation appear to have affected relocation provisions enacted in recent years, including those in the Federal-Aid Highway Act of 1968. These include supplemental payments to home owners and renters to defray higher costs of housing in the areas where they relocate.

Some of the provisions enacted in 1968 to ease relocation of those displaced from highway right of way already are having an effect. For example, nearly 2100 owner-occupants and 2000 rental families received extra payments in 1969 to compensate them for the higher cost of their housing following relocation. This amounts to about 20 percent of the 21,700 families displaced during the year ending September 30, 1969. These payments averaged nearly \$2,300 for owner-occupants and \$1500 for renters, over and above fair market value and moving costs. 18/

While dislocation of people from their homes and businesses generally cannot be regarded as a benefit, a number of people have been able to improve their living conditions following relocation from highway right of way. This will be even more common in the future as highway and other relocation workers learn how to evaluate and replace intangible aspects of the displaced persons environment. Another possible benefit is that the relocation provisions of the 1968 Highway Act are to some extent serving as an example for other Federal programs which displace people from their homes or businesses.

Joint development

Joint development techniques can afford communities a chance to use highways to improve local areas. Joint development involves melding highway and nonhighway uses into a single environmental and functional whole.^{19/} A number of joint development projects are already underway which achieve community as well as transportation purposes. These include the Chicago-Crosstown project, the Baltimore project being developed by the design concept team, the Inner Loop Freeway in Washington, D. C. and the Century Freeway (Watts) project in California.^{20/}

Highways and local planning

Highways play a particularly important part in implementing general plans. Highway systems can be developed by practical stages, they can be funded through established channels, they provide for both private and public transportation, and they can respond readily to changing needs over time.

Highway programs can help achieve both tangible or physical changes in the community and changes of an institutional nature. Some of the physical changes, such as those involving relocation and joint development, have already been mentioned.

Other benefits which communities are achieving include (1) the use highways can have as separators between such land uses as residential and manufacturing, (2) the parklike effect of landscaping on the right of way, scenic easements, rest areas, and screened junkyards, and (3) the opportunity and the need for community planning of development or redevelopment at highway interchange areas.

Some of these highway effects exist in rural as well as urban areas. For example, over 1.5 million trees and tree seedlings are being set out along highway rights of way each year. In most urban areas and in rural areas with few trees, the potential benefit of this tree planting is fairly obvious.

Institutional changes of a beneficial nature can emerge as a result of the intensified efforts now being made to cope with highway location, design, and construction. These efforts include such measures as two public hearings to decide highway location matters to help assure that highways are compatible with their surroundings. Urban design concept teams and other techniques for assuring full community participation in local planning decisions also serve as a valuable supplement to formal governmental procedures for decision making. At highway interchange areas, local planners have sometimes taken the initiative in establishing special interchange districts in local zoning ordinances.

Development and application of the continuing comprehensive transportation planning process carried on cooperatively by local, State, and Federal government demonstrates desire to plan transportation facilities to serve the public interest. This process is concerned with transportation, including highways, and by its very nature must involve land-use planning and the overall economic, social and cultural objectives of the community. Under highway leadership, the urban land-use transportation studies are being conducted on a continuing basis in two-thirds of the 233 urbanized areas of the country, and soon will be in the remainder.

Planning techniques developed in these transportation studies can be used to serve broader goals as these emerge. For example, techniques developed for discerning community attitudes and needs for transportation facilities are useful in solving additional problems such as those experienced in relocation housing, ghetto transportation, community services, and model cities.

Interstate highways and environmental quality

Large scale technological improvements such as the Interstate Highway System often result in profound and sometimes irreversible changes in the natural and man-made environment. Interstate highways can play a vital role in protecting and enhancing the desirable elements of the physical environment -- for example, by increasing opportunities for people to enjoy the beauty and uniqueness of the environment through greater accessibility. Independent alignment of dual-lane Interstate highways improve erosion control, restriction of billboard advertising, and selective tree trimming, all contribute toward increasing opportunities for enjoyment of the environment while protecting its ecological structure. Also, highway agencies frequently develop or assist in programs to protect environmental features of scenic, historical, educational, recreational, symbolic, or ecological significance. For example, a number of States have used Interstate construction to create recreational lakes from excavations for highway construction, rest areas utilizing Indian mounds, dinosaur tracks, or other historic or natural features.

Noise and air pollution

Interstate highways can have a significant beneficial impact in reducing air and noise pollution in urban areas. Interstate highways, often constructed to bypass downtown areas, reduce unnecessary travel through downtown areas where existing noise and air pollution levels are high. Also, Interstate highways eliminate considerable pollution and noise effects of stop-and-go traffic on city streets. The following shows the dramatic improvements expressways can make in reducing automobile carbon monoxide emissions.

<u>Type of traffic situation</u>	<u>Pounds of carbon monoxide per vehicle mile 21/</u>
Expressways	.11
Arterial Streets	.22
Local Streets	.27
Central Business District	.42

The primary reason for this very significant difference in carbon-monoxide emissions is that the amount of unburned gasoline increases sharply when an engine is accelerated or decelerated. For example, when an automobile is cruising, less than 2 percent of the total fuel supplied to the engine is emitted unburned through the exhaust pipe. During deceleration, this increases dramatically to 18 percent. Average speed also plays an important role. A change in speed from 20 mph to 30 mph yields a one-third reduction in total emissions. Air pollution emissions are at a minimum when vehicles are traveling at a relatively constant speed such as on Interstate highways. Similarly, Interstate highways reduce the more disturbing peak noise levels created by trucks and other noisy vehicles by reducing the need for acceleration and deceleration generally characteristic of travel on neighborhood streets.

Recent advances in the design of Interstate highways not only make them more aesthetically appealing, minimize neighborhood social and economic disruption, but are also beneficial in terms of reducing air and noise pollution levels. For example, a modern, well designed elevated structure is visually pleasing, does not inhibit mobility and reduces noise levels in nearby areas. Depressed highways also reduce noise levels. Some Interstate highways are now being designed with exclusive bus lanes which will reduce air and noise pollution by decreasing the number of autos and by providing free-flowing bus traffic. Interstate highways help reduce air pollution levels in urban areas by another indirect way. The relationship between Interstate highway improvements and industrial decentralization is well known. Both the benefits and hardships of the movement of industry from the center city have been well documented. One of the possible benefits is suggested in a recent American Institute of Planning article which states: "Evidence is mounting that urban air pollution problems are caused not only by the presence of such things as smoke stacks and automobiles, but by the overall spatial and temporal arrangement of these urban elements -- in short by urban form." Interstate highways have been instrumental in planning for the spatial arrangements of industrial activity. Much more can be accomplished by both highway and urban planners in considering air and noise pollution in the urban and transportation planning process.

Aesthetics

Interstate highways can and do provide a pleasing aesthetic experience in urban areas. A well known study conducted at the Massachusetts Institute of Technology aptly summarizes this point. "---Road watching, and the highway is -- or at least might be -- a work of art. The view from the road can be a dramatic play of space and motion, of light and texture, all on a new scale. These long sequences could make our vast metropolitan areas comprehensible: the driver would see how the city is organized, what it symbolizes, how people use it, how it relates to him. To our way of thinking, the highway is the great neglected opportunity in city design." 22/

NEW TOWNS AND ECONOMIC GROWTH

The need to encourage growth centers away from existing large cities has been recognized and stated as a national goal. The role Interstate highways can play in this growth is also commonly recognized, whether the growth is occurring in new towns, smaller metropolitan areas, or in areas of the country where economic development needs special encouragement.

New towns and growth centers

Fully cognizant of the growing problem of overcrowded conditions in large cities, the President in his 1970 State of the Union address recommended a national program to disperse into new towns and smaller communities or growth centers some of the huge population growth this Nation will experience by the end of the century. The President suggested that future decisions of the Federal government with respect to buying and selling land, building highways, airports and other public facilities be made "with the clear objective of aiding a balanced growth for America." The policy includes encouragement of growth in smaller urban areas -- of 50,000 to 250,000 population. It is in the hope of countering high social costs associated with growth in larger, more congested areas.

Interstate highways will play a major role in helping to achieve this very important national goal. These highways will be crucial in effectively integrating new towns and smaller metropolitan areas and growth centers with the surrounding countryside and with other towns and major metropolitan areas.^{23/} Some indication of the effects of Interstate highways can be gleaned from experience with such towns already completed or in the process of being built. For example, Columbia, situated between Washington, D. C. and Baltimore, Maryland, claims proximity to several highways and Interstate routes among its transportation assets.^{24/}

In contrast to the transportation avenues open to Columbia, the new town of Reston may not be as favorably located. In fact, the developers of the Reston area have decried the lack of access to the Dulles Airport Access Road, between Dulles Airport and Washington, D. C. as one of the major factors which has contributed to the slow development of the new town of Reston.^{25/}

The emphasis which new town developers place on modern, well-landscaped highway facilities is borne out in a statement by a representative of the James W. Rouse and Company, developers of Columbia, Maryland. He states: "We are putting a great deal of effort into having Route 29, which cuts our property in half, upgraded to a limited-access six-lane landscaped parkway. We have recently purchased three sites zoned for shopping centers for up to \$15,000 an acre just to take them off the map. We are satisfied that this is an important step and that the values in the community will be maintained and improved by wiping out roadside commercialism." In enumerating the reasons for selecting the site for Columbia, he stated "... it had to be in a location where there was either an existing or a planned

major transportation system. By this I mean not railroads or airlines but highways. Our studies led us to conclude that Howard County was on the verge, with the powerful and extensive Maryland State Highway program, of being crisscrossed with some of the really great highways planned in the area, including I-95." 26/

Vital to "self contained" new towns are sufficient employment opportunities for its citizens. This, in most cases, will require a strong industrial base which in turn is dependent on a good inter and intra-city transportation system. A majority of the studies dealing with factors related to the location of new industrial plants show that highway transportation ranks high. For example, in one questionnaire survey, 72% of the 1363 replies mentioned "proximity to good highways" as a factor weighting heavily in the selection of a plant site. Highway transportation ranked first among a total of 13 factors mentioned. 27/

Although provision of employment opportunities within the new community is a primary goal of most new town developers, they also understand the possibility of a lag between the time that the residential sections are built and the time that industry is attracted to the area in sufficient quantity. In the meantime, residents must have the means for commuting to other available employment centers. Furthermore, some estimates indicate that about 50 percent would probably be close to the maximum percent of total employment which will be provided in many new towns. In the case of Columbia, for example, about 50 percent of all employed residents were expected to find jobs in Columbia, 30 percent in Washington, and 20 percent in Baltimore. 28/ The need for modern highways between the new town and the old centers of employment is well established in the case of the two new towns of Reston and Columbia in the Washington-Baltimore Area.

It is conceivable that much of the future population growth of the United States will take place in new towns in the open spaces between established metropolitan areas. In large measure, the future of new towns will depend on adequate ground transportation between these new towns and the established metropolitan areas and on adequate transportation between the industrial sections of these new towns and the markets which will be provided by the old urban areas. A system of modern, safe and convenient limited access highways will be needed to serve the new towns in their roles as producers, distributors, and consumers of various commodities and to provide the citizens of these communities with the social and cultural opportunities they need and desire.

Underdeveloped areas

The lack of adequate highways has sometimes been associated with economic lag. Policy studies have advised highway construction to encourage economic development in underdeveloped areas.

The Connecticut Turnpike was built primarily to improve the local economy, not to meet existing traffic demands. The benefits expected have materialized. Manufacturing employment in the area served by the Turnpike increased by 27 percent between 1956 and 1962, compared to no change for the State as a whole and to a slight decline in the control areas some distance from the Turnpike. New firms and existing firms reporting increases in employment considered transportation to be a contributing factor. Wage levels also moved upward in the Turnpike area more than in the State as a whole or in the control areas. 29/

Improvement of the Appalachian economy also emphasizes highway development. Recently, a member of the Appalachian Regional Commission reported that progress on the Appalachian Development Highway System in conjunction with the Interstate are having a measurable impact in terms of improved locational advantages for many areas. These highway systems dramatically revise travel times, for example, from

- 10 to 6 hours for the Charleston, West Virginia to Washington, D.C. trip and from
- 3.5 to 1.5 hours for the trip from Hazard, Kentucky to Lexington.

Hazard is a mountain community with excess workers who can now commute to Lexington where jobs are available.

On the basis of two important measures of prosperity--average income and the rate of unemployment--the Appalachian region has actually shown improvement during the last few years relative to the rest of the Nation. Development related to Interstate highways suggests that the System is playing a significant role in this improvement. For example, with completion of several sections of Interstate highways near the Scranton-Wilkes Barre area, a new function has developed for these communities--as a distribution center for the region around New York City, 100 miles away.

Underdeveloped areas tend to be assisted not only by the transportation improvements of completed Interstate highways but by the economic activity generated during highway construction. For example, some industries supplying highway construction needs, such as stone and clay products, are concentrated in depressed areas. Also, over half of the expenditures for highway construction are for mileage in areas where income is low and net emigration and unemployment rates are high. Employment has been found to depend more on highway construction in rural, low income States such as West Virginia, Wyoming, and Mississippi than in such high income States as California, Maryland, Massachusetts and New York.

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The increase in recreational travel as the Interstate System is completed is also illustrated by the Kansas I-70 study where vacation trips increased from 30.6 to 43.5 percent of the total in the 1-year period 1964-1965. Trips with both origin and destination beyond Kansas about doubled from 645 per day in 1962 to 1,287 or nearly 11 percent of the corridor total in 1965. The Kansas study also indicates the use of the Interstate for the long distance family trip with average car occupancy of 2.79 persons per car on I-70 19 percent greater than on the paralleled route in 1965. The vacation travelers averaged 3.50 persons in each car, had an average trip length of 1,201 miles and accounted for 43.5 percent of all trips through the study area. When other social and recreational trips are added this increases to 62.4 percent of the total.

- 17/ Litz, L.E., Lieder, N., and McCann H., "Summary of the 1968 National Rest Area Usage Study, July 1969," Highway Planning Technical Report,
 Number 16, July 1969.

- 18/ Just how many of the families displaced in the future by Federal-aid highways will be eligible for additional payments appears to depend primarily on the housing supply available for families displaced. However, the present 10 percent of those displaced who qualified for additional payments seems likely to increase. Only about half of the States were able, under State law, to make such additional payments during the past year, and the number of displacements during the year -- 21,700 -- was significantly lower than the 50,000 to 55,000 expected. Currently, displaced households are predominantly urban (80 percent) and white (75 percent) with owners and tenants about equally divided. Of those recently displaced, one-fourth occupied residences valued below \$6,000 or renting for below \$60 monthly, one-half occupied residences valued between \$6,000 and \$15,000 or renting for \$60 to \$110, and one-fourth occupied residences valued at more than \$15,000 or renting for over \$110 monthly.

- 19/ Joint development may include airspace utilization and multiple use of highway rights of way. Opportunities for developing the space above Interstate highways will be greatly enhanced as techniques are developed for scrubbing exhaust gases to remove impurities.

- 20/ The Chicago Crosstown project provides a transportation system appropriate for existing residential uses nearby as well as commercial uses that may eventually displace these residences. In Baltimore, the interdisciplinary team approach is being used to deal with the complex social, aesthetic, and environmental implications of the proposed highway. The Inner Loop Freeway in Washington makes good use of scarce land by acquiring whole blocks, by decking over the highway, and by using the enlarged area for a park and for low and moderately priced housing. Finally, the Watts California project has involved locating freeways to accord with the wishes of local homeowners desiring relocation and renters hesitant to move; replacement housing is constructed some distance from the right-of-way. "Freeway Corridor Planning", Darwin Stuart, Highway Research Board Paper (unpublished) pp. 18-28; and "The Joint Development of Housing and Freeways." A Study by Tippetts-Abbett-McCarthy-Stratton for the D.C. Department of Highways and Traffic and the Bureau of Public Roads, 1967, pp. 10-12; and "Joint Development and Multiple Use of Transportation Rights of Way", Highway Research Board, Special Report No. 104, 1969.
- 21/ American Road Builder, January 1969.
- 22/ "The View from the Road", D. Appleyard, K. Lynch and J. R. Meyer, M.I.T., 1964.
- 23/ According to Robert C. Weaver, "Almost every planned community under construction is oriented closely to a major highway or highway interchange. And even though some of the planned communities stress high levels of employment within the community itself, all recognize the continuing need for convenient and reliable central city travel."
- 24/ "Welcome to Columbia", a visitors guide to the new city states: "The Cove" (a separate village in Columbia) is only 12 minutes from the Baltimore Beltway and 20 minutes from both the Capital Beltway and Friendship Airport."
- 25/ "The problem of how to get in and out of Reston is a major one which Reston alone can't solve --- citing the current impasses on highway construction and the "limited access" Dulles Highway as sources of major concern over Reston's future", Robert B. Semple, Jr., The New York Times, October 13, 1967.
- 26/ "Columbia, Maryland -- A New Town for America", Highway Research Record, No. 97, p. 18.
- 27/ "Highways, Trucks and New Industry" American Trucking Association, 1963.
- 28/ Unofficial Report, dated October 6, 1966, on a meeting with officials of the Rouse Company, Developers of Columbia, Maryland, Carl N. Swerdloff.
- 29/ Walter C. McKain, The Connecticut Turnpike: Ribbon of Hope, University of Connecticut, 1965.

