Chapter 2.—CHARACTERIZATION OF THE AUTOMOBILE TRANSPORTATION SYSTEM

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CHARACTERIZATION OF THE AUTOMOBILE TRANSPORTATION SYSTEM

CHAPTER 4

The automobile transportation system can be described in many ways. Chapter 1 includes an informal description that offers some perspectives on the role that automobiles and highways play in our society, This chapter provides a different kind of description—a more formal characterization that defines the major elements of the automobile transportation system and shows the relationships among these elements. The purpose is to describe, in quantitative terms, the parts of the system and to delineate the effects that the automobile system has on society.

Figure 1 is a diagram of the major elements of the automobile transportation system. These elements are shown by the boxes lettered *A* through *M,* The arrows indicate the principal interactions among the elements of the system. For simplicity, no attempt has been made to diagram all of the relationships. Only those that represent the major links among the social, economic, political, and institutional parts of the system are shown. The diagram also illustrates how stakeholders influence the automobile system and, in turn, are affected by it.

Stakeholders

The stakeholders in the automobile system are many and diverse. In one way or another, everyone can be considered a stakeholder with interests in the benefits conferred by the automobile and in the costs that it imposes. Most individuals and organizations hold not one, but several stakes which may conflict at times. For example, there is the automobile owner and user who might favor policies to promote fast and uncontested driving conditions, but who might be opposed to a planned highway affecting his neighborhood and property values. Similarly, there might be unanimity within the auto industry on policies to promote the use of the automobile, but sharp division of opinion on a standard requiring some safety device. The parts supplier might view the standard as advantageous, while the automobile manufacturer might see it as cutting into sales.

There are many examples where individuals, organizations, and institutions find different aspects of their self-interest in conflict. There are also many instances in which stakeholders may group together on one policy issue but realine with other stakeholders on other issues. Because stakeholder interests are so varied and conflicting, it is not possible to show their relationship to the automobile system in a simple diagrammatic *way.* The lines in figure 1 connecting stakeholders to the automobile system are intended only to suggest the major avenues through which stakeholder interests are brought to bear and through which stakeholder interests are affected.

Policies (A)[1]

There are hundreds of policies that have a direct or indirect effect on the characteristics and use of the automobile system. For this study, the list of present policies has been limited to those that have a major and direct influence on automobiles and highways, on industry structure, on institutional relationships, or on personal transportation. These policies are cited in table 1, where they are grouped according to the five categories of issues addressed in this study.

[1]The letters refer to the corresponding boxes in the automobile system diagram, figure 1.

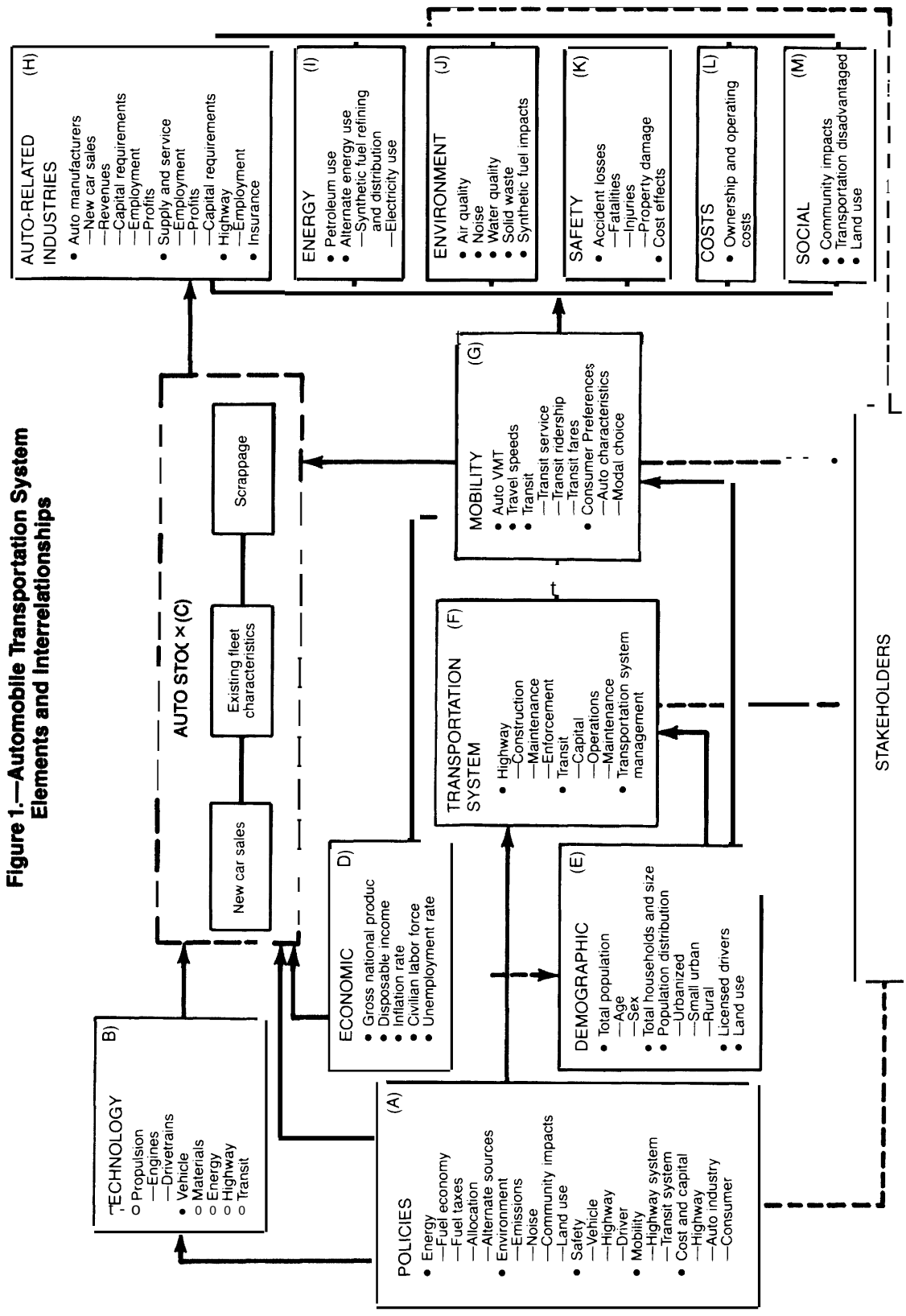


Figure 1.—Automobile Transportation System Elements and Interrelationships

SOURCE: Office of Technology Assessment.

Table 1 .—Major Policies Affecting the Automobile Transportation System

Title	Provisions
Energy	
Emergency Highway Energy Conservation Act of 1974 (PL 93-239)	Required States to reduce speed limit to 55 mph on all highways
	Provided for carpool demonstration projects
Federal-Aid Highway Act Amendments of 1974 (PL 93-643)	Extended 55-mph speed limit indefinitely
Energy Policy and Conservation Act of 1975 (PL 94-163)	Standby authority for gasoline rationing
	Mandated new car fleet average fuel economy (27,5 mpg by 1985)
Electric and Hybrid Vehicle Research and Development Act of 1976 (PL 94-41 3)	Established program to develop and demonstrate electric or hybrid vehicles
Environment	
Department of Transportation Act of 1966 (PL 89-670)	Declared a national policy to protect and preserve natural, recreational, and historic sites from intrusion by highways
National Environmental Policy Act of 1969 (PL 91-190)	Established requirement for assessment of environmental impacts of public works projects (including highways)
	Established Council on Environmental Quality
Federal-Aid Highway Act of 1970 (PL 91-605)	Required development of guidelines to control adverse economic, social, and environmental impacts of highways
	Required Federal-State cooperation for long-range highway planning
Uniform Relocation Assistance and Land Acquisition Policies Act of 1970 (PL 91-646)	Established uniform policy for land acquisition and treatment of persons displaced by highways
Clean Air Act of 1970 (PL 91-614) and 1977 Amendments (PL 95-95)	Established standards for CO, HC, and NO_x emissions by new autos
	Required inspection and maintenance programs in certain urban areas
Noise Control Act of 1972 (PL 92-754)	Authorized establishment of noise standards for products distributed in interstate commerce (including automobiles)
Safety	
National Traffic and Motor Vehicle Safety Act of 1966, and Amendments (PL 89-563)	Established National Traffic Safety Agency (later NHTSA)
	Set safety performance standards for motor vehicles
Highway Safety Act of 1966 (PL 89-564)	Established National Highway Safety Agency (later NHTSA)
	Required States to have a highway safety program to reduce reduce death, injury, and property damage
Motor Vehicle Information and Cost Savings Act of 1972 (PL 92-513)	Required use of energy-absorbing bumpers
Highway Safety Act of 1973 (PL 93-87)	Authorized Federal-aid highway funds for safety programs and safety R&D
Mobility	
Federal-Aid Highway Acts 1954 through 1976	Appropriated funds for federally aided highway systems
	Designated the National System of Interstate and Defense Highways and appropriated funds therefore
	Provided for use of highway funds for certain mass transit improvements
Urban Mass Transportation Act of 1964 (PL 88-365)	Provided for Federal assistance in developing improved transit facilities, equipment, and techniques
	Encouraged planning and establishment of areawide mass transit
	Provided assistance to State and local agencies in financing transit capital improvements and operations
Cost ***and Capital***	
Highway Revenue Act of 1956 (PL 85-823)	Imposed a Federal tax of 4¢/gal on motor fuel
	Established Highway Trust Fund
	Established pay-as-you-build principle
Motor Vehicle Information and Cost Savings Act of 1972 (PL 92-513)	Required a consumer information study to examine susceptibility to damage, crashworthyness, and characteristics of the repair system
	Provided for diagnostic demonstration projects
	Prohibited odometer tampering
Magnuson-Moss Warranty Act of 1974 (PL 93-637)	Established automobile warranty requirements
	Authorized FTC to make rules on unfair or deceptive warranty practices

Technology (B)

The basic technology of the automobile has changed very little over the years. Although major improvements and refinements have been added, the internal combustion (Otto cycle) engine remains virtually the only means of propulsion. The fuel is still almost exclusively gasoline. Transmission, suspension, chassis, and body designs are not fundamentally different from those of early automobiles. However, the modifications that have been made to the basic technology have made a difference, and the operating characteristics of the automobile have substantially improved over time. Among the innovations that have been introduced are the electric starter, the automatic transmission, power-assisted braking and steering, emission control, electronic regulation of ignition and carburetion, and improved occupant safety and comfort.

The development of the automobile system over the remainder of this century will be determined largely by technological changes that are already under development—alternate engines, improved drivetrains, safety devices, emission control equipment, and vehicle downsizing. These coming changes will be influenced more strongly by Government policy than were those in the past. They will place demands on the automobile industry to improve fuel economy, reduce emissions, and increase occupant safety. Consumer preferences and acceptance of public policy goals will also exert influence on automobile technology—either directly, through mechanisms of the marketplace, or indirectly, through the political process.

The effects of national policies on automobile manufacturers and parts suppliers will depend, in part, on the ability of the industry to generate the capital needed for development of new technology along the lines dictated by policy. Capital formation, in turn, depends on consumer acceptance of the products and on the profitability of the resulting sales mix.

Auto Stock (C)

The performance of the automobile transportation system depends on the composition of the vehicle fleet and changes in the characteristics of the fleet over time. (See table 2.)

Table 2.—Characteristics of the Automobile Stock, 1976

	Volume (millions)	Percent of new car sales[a]
New car sales		
Subcompact	2.23	22
Compact	1.92	19
Small luxury	0.51	5
Intermediate	2.83	29
Standard	2.02	20
Large luxury	0.61	6
Total	10.12	
Auto fleet		
Size	97,800,000	
Average age	6,2 years	
Annual scrappage rate	70/0	

[a]Does not sum to 100 because of rounding.
SOURCE: Sydec/EEA analysis of data from Motor Vehicle Manufacturer's Association, *Motor Vehicle Facts and Figures '77*, pp. 20 and 34.

Auto prices, operating costs, and the demand for travel influence the level and the mix of new car sales. Demographic factors also influence the growth of new car sales.

The annual introduction of new cars and the rate of retirement of old cars determine the range and average of fuel economies, emissions, and performance features of the auto fleet. These characteristics, in turn, help determine total gasoline consumption, emissions levels, and death and injury levels.

The rate of retirement of cars is primarily a function of age, although other factors such as cost of operation and repair, personal income, and changes in household composition also influence scrappage. Less than 6 percent of the cars on the road are over 13 years old, and the average age is slightly over 6 years. Between 6 and 10 percent of the fleet is scrapped each year.

Economics (D)

Macroeconomic conditions have a primary and direct effect on the use and characteristics of the auto system. The key economic factors include gross national product, disposable personal income, inflation rate, civilian labor force, and unemployment rate. (See table 3.)

Disposable personal income and employment are major determinants of consumer behavior.

Photo Credit General Motors Corporation

Table 3.—Selected 1976 Economic Data

Gross national product ... . $1.7 trillion	
Disposable personal income. .. .$1.8 trillion	
Disposable personal income per capita. $5,486	
Consumer price index[a]. 170.5	
Civilian labor force . .....94.8 million	
Unemployment rate . .....7.7 percent	

[a]1967 = 100
SOURCE: U.S. Department of Commerce, Bureau of the Census, *Statistical Abstract of the United States*, 1977

They influence the number and type of new autos sold, the length of time a car is kept in use, and the amount of travel. There is a close correlation among household income, the number of autos owned, and the number of miles traveled. When the economy is growing steadily, and when inflation rates are low and employment high, there is more personal income available for the purchase and use of automobiles.

Demographics (E)

Population growth, the number and size of households, their geographic distribution, and the number of licensed drivers are some of the factors that determine the size of the auto fleet and how it is used. In addition, the sex of the drivers also influences the amount of auto use. In 1975, over **90** percent of males of driving age had licenses. About 70 percent of driving-age females were licensed.[2] Male drivers *use* autos more extensively than females in all age categories; on the average, males drive about twice as many miles per year as females. [3]

Demographic factors, along with economic conditions, are determinants of residential location and, consequently, of population distribution. The important characteristics of the current population distribution are listed in table **4.**

Table 4.—Selected 1976 Demographic Data

Total population	215.1 million
Urbanized areas[a]	132.0 million
—Central cities	67.2 million
—Suburbs	64.8 million
Small urban areas[b]	29.3 million
Rural areas	53.8 million
Total households	72.9 million
Persons per household	2.9

[a]Areas of 50,000 or more population.
[b]Urban places of 2,500 to 50,000 population.
SOURCE: Sydec, from Bureau of the Census Series II data.

The nature and amount of auto travel is heavily influenced by land use—the pattern of residences in relation to business and recreational

[2]U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics Summary to 1975* (Washington, D.C.: U.S. Government Printing Office, 1977).
[3]U.S. Department of Transportation, Federal Highway Administration, *Nationwide Personal Transportation Study (1969-1970).*

centers. Density of development is also an important factor. Demand for auto travel tends to be high where residential densities are low and where residences are distant from commercial and recreational sites. Auto travel demand is lower, on the other hand, in areas where commercial establishments and employment are interspersed with, and in proximity to, residences.

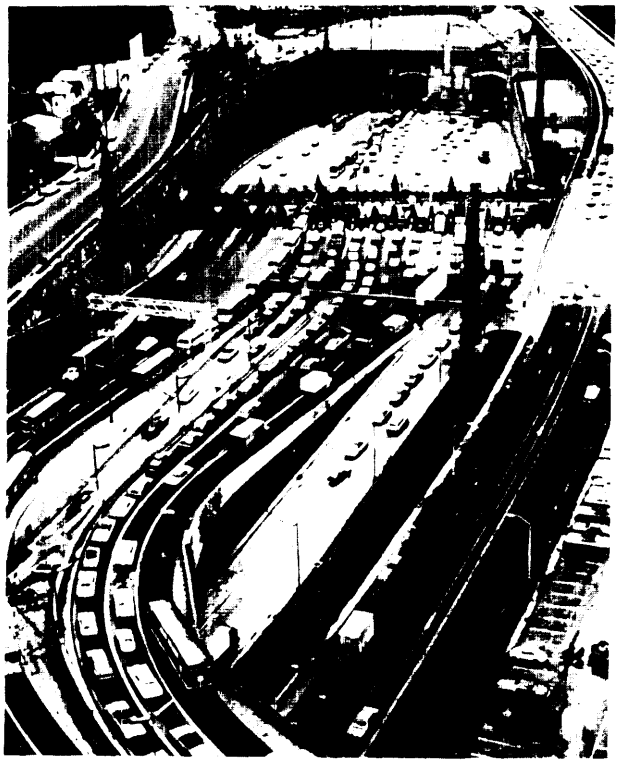


Photo Credit: U.S. Department of Transportation

Transportation System (F)

This portion of the system is made up of the facilities for personal transportation by auto and public transportation. It includes both highways and exclusive rights-of-way for public transportation. It also includes the transportation management system, which affects the relationship of highways and transit and determines the efficiency of their combined operation.

The location and type of highway facilities and the number of miles in the highway system are influenced by a variety of factors. The geographic distribution of population and, particularly, the juxtaposition and density of land uses determine the miles of highway needed and the feasibility of using mass transportation to satisfy some of the travel demand.

Federal policies strongly influence the size and location of highways by determining the amount of funds available, the types of facilities assisted, and the relative emphasis among transportation modes. (See table 5.) Other policies, such as fuel taxes and fuel-economy standards, affect Federal revenue and hence the funds available for highway construction, maintenance, and operation. Macroeconomic conditions also affect the amount of construction and maintenance that can be accomplished either with revenues from road users or with other legislatively appropriated funds.

Table 5.— Highway and Transit Expenditures, 1976 (billions of dollars)

	All government	Federal
Highways		
Capital	$14.30	$7.53[a]
Maintenance & other noncapital [b]	15.48	0.36
Total	29.78	7.89
Transit		
Capital	NA[c]	1.28[d]
Operating assistance	**1.65**	**0.43**
Total	—	**1.71**

[a]Includes $6.09 billion from the Highway Trust Fund, $1.07 billion of payments from other funds, and $0.375 billion in direct Federal expenditures.
[b]Includes administration, police, planning, research, and debt service.
[c]Not available.
[d]UMTA Section 3 authorizations; includes the transition quarter.
SOURCES: Federal Highway Administration, *Highway Statistics 1976*, table HF-10, p. 49. American Public Transit Association, *Transit Fact Book*, '76-'77 Edition, p. 20.

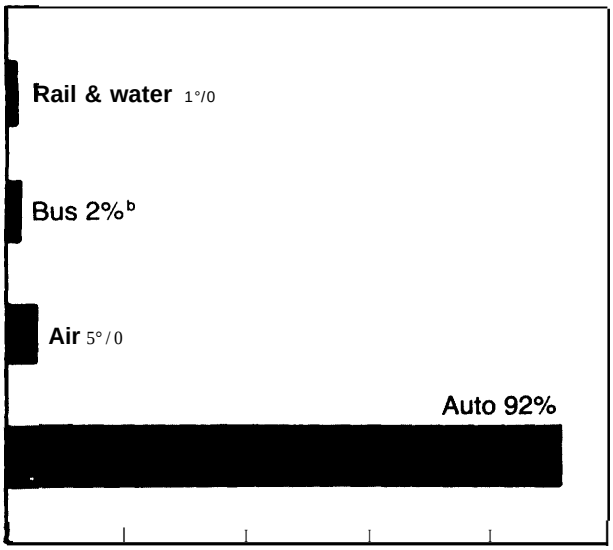
Mobility (G)

Mobility, defined as the satisfaction of travel demand, is the basic purpose of the automobile transportation system and the major benefit conferred by it. The parameters of mobility are number of trips, trip length, number of persons served, and the mode of transportation. Measured on any of these dimensions, the automobile is the dominant form of personal transportation in the United States. (See figure 2.) Each year automobiles accumulate over 1 trillion vehicle miles and account for over **90** percent of all passenger miles traveled. Mass transit, the major alternative to the automobile in urban areas, is an important substitute for some types of trips

Photo Credit: U.S. Department of Transportation

(notably the journey to work) but, in the national aggregate, accounts for under 2 percent of passenger miles traveled. (See tables 6 and 7.)

Figure 2.—Modes of Personal Transportation[a]



[a]1975 Data.
[b]Excludes school buses

SOURCE: U.S. Department of Transportation *National Transportation Trends and Choices (to the Year 2000)*, 1977, p. 85.

The magnitude of the effects of the automobile cannot be measured solely in terms of mobility, even though this is the ultimate purpose of the system. The characteristics and use of automobiles have important consequences in several areas. These are shown in boxes H through M of the automobile system diagram (figure 1) and described in the remaining sections of this chapter,

Table 6.—Passenger Car Use*

Purpose of travel	Percent distribution: Percent of trips	Percent distribution: Percent of travel (VMT)	Average trip length one-way (miles)
Work, including commuting	36	42	10.2
Family business, including shopping	31	19	5.6
Education, civic, or religious	9	5	4.7
Social and recreational	23	33	13.1

*1969 data.
SOURCE: Federal Highway Administration, *Nationwide Personal Transportation Study*, Report No. 10, "Purpose of Automobile Trips and Travel," 1974, p. 13.

Table 7.—Public Transit Ridership, 1977

Linked passenger trips[a]	(millions)
Rail	1,425
Trolley	51
Motor bus	4,247
Total	5,723
Average fare..,	37.7@

[a]Linked transit passenger trips are identical to revenue passengers, except that free-fare, originating passengers are included in linked trips.
SOURCE: American Public Transit Association, *Transit Fact Book*, '77-'78 Edition, pp. 27 and 32.

Automobile= Related Industries (H)

Some indication of the importance of the automobile system can be gained from the employment figures for industries directly involved in motor vehicle production and use.

- Motor vehicle and parts manufacturing—1,013,000
- Auto and parts retail dealers—1,152,000
- Auto and parts wholesale dealers–394,000
- Services and garages–476,000
- Gasoline service stations–624,000
- Construction of highways and streets—339,000
- Petroleum industries—427,000
- State and local highway departments—587,000.[4]

In addition to these 5 million employees, another estimated 400,000 people are employed by industries that serve as suppliers to auto manufacturers. [5]

Federal policies, in the form of automobile performance regulations, have a major effect on the automobile industry. Development of new technologies to satisfy these requirements bears directly on capital needs and on employment and profit levels in the manufacturing, auto supply, and service industries. The need for specialized diagnostic and maintenance equipment to service cars with new emission and fuel-saving devices, for example, could affect the concentration and size of firms in the auto service industry and add pressure on the labor market for skilled mechanics.

Personal disposable income is directly correlated with new car sales. Population distribution, the patterns and density of land use, and the nature and extent of the Nation's transportation system strongly influence auto travel demand, which in turn determines the size and composition of the auto fleet. Changes in fleet characteristics have a wide range of effects on auto-related industries, including the size and mix of new car sales, market shares among auto manufacturers, employment levels, profits, and the level of claims in the insurance industry. Table 8 presents some of the highlights of automobile industry economics.

Table 8.— Financial and Economic Data for the Automobile Industry[a] (1975 dollars)

Average new car price by size class	
Subcompact	$ 3,600
Compact	$ 4,200
Small luxury	$ 5,650
Intermediate	$ 4,600
Standard	$ 5,400
Large luxury	$ 8,000
Gross revenue per domestic car sold	$ 4,990
Annual domestic sales (thousands)	8,610
Annual domestic sales revenue (millions)	$42,950
Capital investment (millions)	$ 3,640
Auto manufacturing employment (domestic)[b]	948,000
Profit margin (1977) (percent)[c]	
U.S. auto industry	4.6
All manufacturing	4.5
U.S. auto industry net income (1977) (millions)	$4,590
GMC	$ 2,960
Ford	$1,480
Chrysler	$ 145
AMC	$ 5
U.S. auto industry net income as a percent of sales (1977)	4.6
GMC	6.1
Ford	
Chrysler	(1.0)
AMC	(0.3)

[a]1976 data except as noted.
[b]Employment figures are for domestic manufacturers and include auto parts manufacture.
[c]Net income after taxes as a percentage of net sales.
SOURCES: Motor Vehicle Manufacturers Association, *Motor Vehicle Facts and Figures '76*, 1976, p. 16; Securities and Exchange Commission, Auto manufacturer's annual reports to the SEC; Wards Communications, Inc., *Wards 1977 Automotive Yearbook*, 1977; and Council on Wage and Price Stability, *Staff Report on 1977 Automobile Prices*, Washington, D.C., Oct. 27, 1977.

'Transportation Association of America, *Transportation Facts and Trends*, Fourteenth Edition (Washington, D. C.: Transportation Association of America, 1978), p. 23.

'Motor Vehicle Manufacturers Association, *Motor Vehicle Facts and Figures* '78 (Detroit: MVMA, 1978), p. 68,

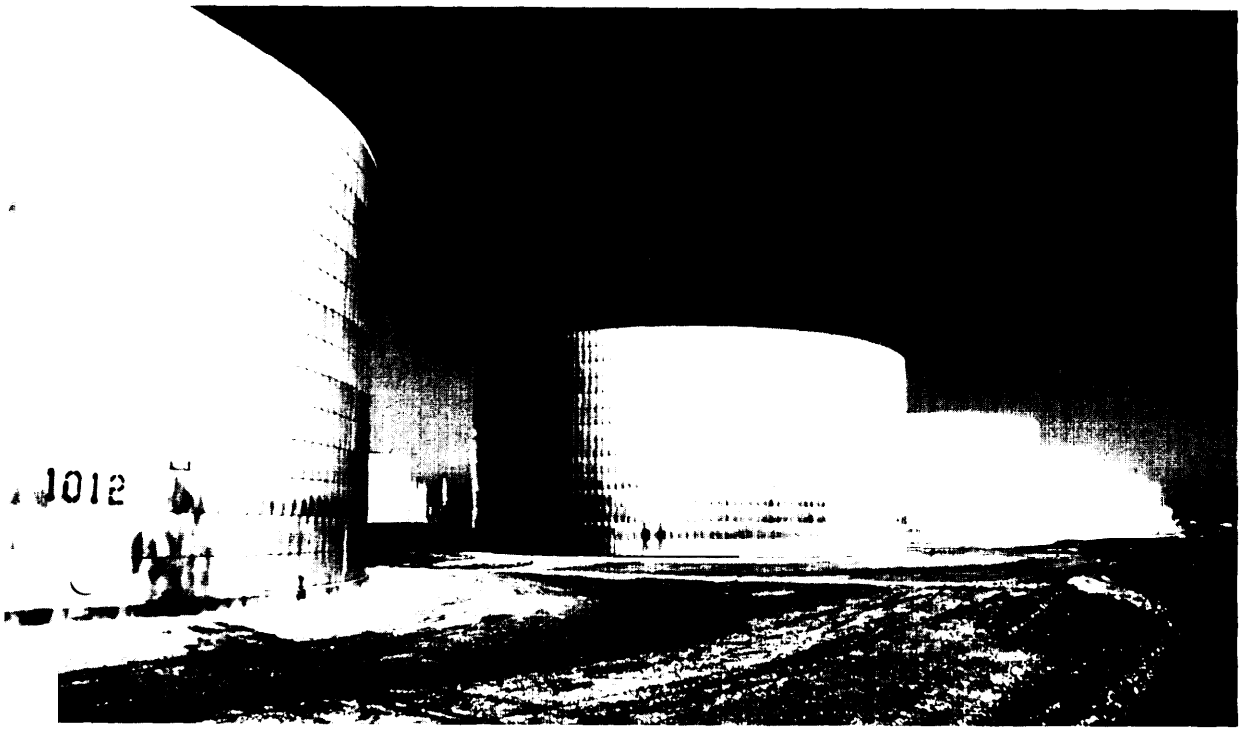


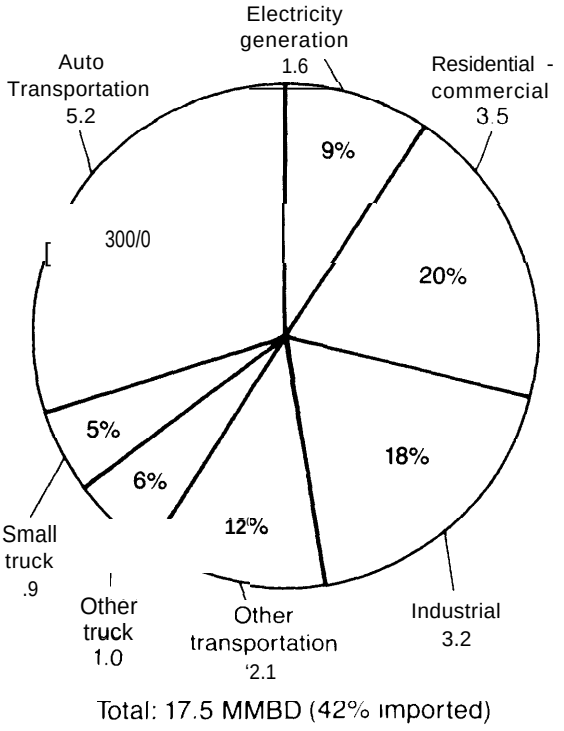
Photo Credit: U.S. Department of Energy

Energy (1)

Automobile transportation is the largest consumer of petroleum in the United States —5.2 million barrels per day, or about 30 percent of total demand. (See figure 3.) Virtually all of the petroleum consumed as automobile fuel is in the form of gasoline. Historically, gasoline consumption has grown at a rate of slightly over 4 percent per year. In the years immediately preceding the 1973-74 oil embargo, the annual growth reached nearly 5 percent. While the growth rate has slackened somewhat since, it is currently above 4 percent and rising. The annual consumption of petroleum by automobiles was over 78 billion gallons in 1976.

Energy consumption is directly influenced by automobile travel demand and by propulsion system technology. While gasoline is now the only significant auto fuel, diesel engines are beginning to penetrate the passenger car fleet. Synthetic fuels (coal liquids, shale oil, methanol, and ethanol) and electric power are potential alternatives to gasoline, but they are now only in the developmental stage.

Figure 3.—U.S. Demand for Oil in 1976 (MMBD)



SOURCE: Executive Office of the President, *The National Energy Plan,* April 29, 1977.

Environment (J)

The effects of automobile use on air quality have received wide public attention since the **1960's.** Automobile emissions are considered to be a major contributor to air pollution, primarily in urban areas. Automobiles are major sources of carbon monoxide, hydrocarbons, and nitrogen oxides. Figure 4 shows the relative contribution by automobiles to atmospheric pollution.

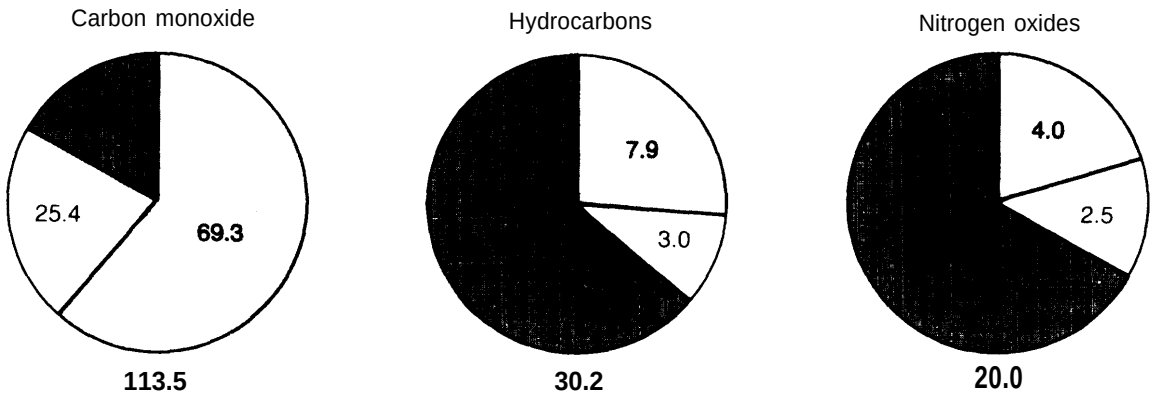
Noise, water pollution, and soil contamination are other environmental impacts of automobiles; however, in each case, other sources are larger contributors. The disposal of automobile wastes, notably scrap vehicles, is a problem of sizable proportion. Scrappage of automobiles accounts for about 7 percent of all commercial, residential, and municipal waste in the United States. Since the average weight of a vehicle is about 3,900 pounds, automobiles comprise over 13 million tons of solid waste that must be disposed of annually. Of this, 10 million tons, or about **80** percent, are salvaged and represent an important source of recycled iron, steel, and other metals. Figure 5 illustrates the composition of a typical 1978 model car.

Safety (K)

The safety of the automobile system—measured in terms of fatalities, injuries, and property damage—is a matter of profound concern. The 1977 data in table 9 show only the rough dimensions of the problem, but they serve to indicate the high price that Americans pay for mobility.

Traffic crashes in rural areas makeup approximately **30** percent of the total but account for 70 percent of the deaths and 35 percent of the injuries. The condition of rural roads, the higher prevailing speeds, and he unavailability of

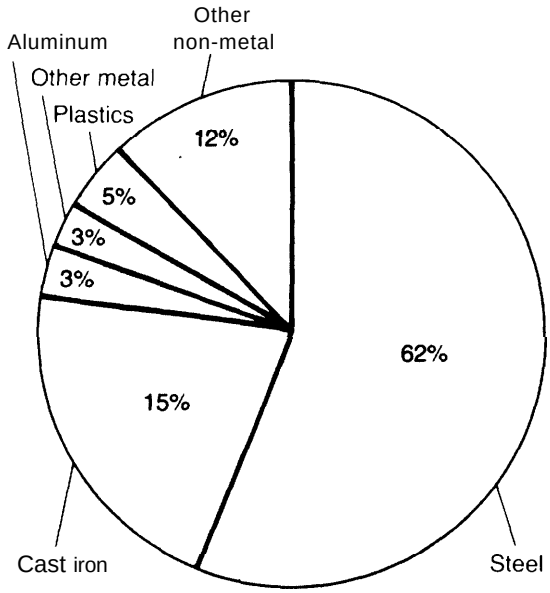
Figure 4.—Sources of Air Pollution[a]



[a]1975 Data,
[b]Passenger cars only,
[c]Light-duty trucks, heavy-duty trucks (gasoline and diesel), buses, motorcycles, aircratt, pipeline, marine craft, and military vehicles

SOURCES: EEA Gasoline Consumption Model.
TRC and Argonne National Laboratory, *Priorities and Procedures for the Development of Standards of Performance for New Stationary Sources of Atmospheric Pollution,* 1976.

Figure 5.— Materials in a Typical 1978 Model Automobile



SOURCE Ward's 1978 Automotive Yearbook, 1978

Table 9.—1977 Traffic Crash Data

Crashes[a]	17,600,000
Vehicles involved[a]	29,800,000
Injuries[b]	4,392,000
Deaths[c]	47,700
Auto occupants	27,400
Pickup, van occupants	5,200
Motorcycle	4,200
Pedestrian, pedacycle	8,600
Truck, bus, and other	2,400
Estimated cost[d]	$44 bill ion

[a]OTA estimates from National Safety Council data.
[b]U.S. Public Health Service.
[c]U.S. Department of Transportaiton Fatal Accident Reporting System, figures rounded.
[d]U.S. Department of Transportation, updated area, originally from "1975 Societal Costs of Motor Vehicle Accidents." This figure does not Include costs associated with pain, suffering, loss of relationship, etc.

emergency medical services are major factors contributing to the disproportionate number of rural highway deaths and injuries.

Costs (L)

The costs of the automobile are distributed throughout the system, but they are eventually assumed by the public, either directly as automobile users or indirectly as taxpayers. Some of these costs have been discussed earlier—for example, highway and transit costs in connection with the transportation system (F'), new car costs under industry economics (H), and fuel costs under energy (I). The discussion that follows deals only with costs that fall directly on the consumer as an automobile owner and operator.

From 1962 to 1973, the real dollar cost of owning and operating an auto declined about 6 percent. Gasoline and motor oil costs in the same period declined more rapidly than total costs until the sharp OPEC price increase in 1973-74 brought fuel costs back to the 1962 level in real dollars. Auto repair and maintenance costs, constant through the mid-1960's, have gradually declined over the last decade by about 10 percent in real dollars. Significantly, new car costs have been declining steadily and at a greater rate than other auto-related costs—more than a 30-percent decline in 15 years in real terms. Table 10 is a summary of the costs of automobile ownership and operation in **1976.**

Table 10.—Costs of Owning and Operating an Automobile, 1976 (cents per mile)

Costs[a]	Type of auto		
	Stand-ard	Com-pact	Sub-compact
Depreciation	4.9	3.8	3.2
Maintenance, accessories, parts, and tires	4.2	3.4	3.1
Gas and oil (excluding taxes)	3.3	2.5	1.8
Garage, parking, and tolls	2.2	2.1	2.1
Insurance	1.7	1.6	1,5
State and Federal taxes	1.6	1.2	0.9
Total costs per mile	17.9	14.6	12.6

[a]Based on driving 10,000 miles per year.
SOURCE: Federal Highway Administration, *Costs of Owning and Operating an Autonrobl/e,* 1976, p 2

Social Effects (M)

The automobile system affords a myriad of social benefits, but it also has many adverse effects on individuals and communities. Generally, these adverse effects fall into three categories:

1. Increased highway travel creates pressure to build or expand highways, leading to disruption of communities by property acquisition and displacement of residences, businesses, and other activities.

2. Increased traffic volumes raise noise levels within neighborhoods and endanger pedestrian safety.
3. Increased reliance on the automobile by the population as a whole tends to draw passengers away from public transportation, shrinking its market, forcing reductions in service, and contributing to increases in fares. The elderly, the handicapped, the young, the poor, and others without cars may have their mobility reduced as a result.

One measure of community disruption by the automobile system is the number of homes and businesses displaced by highway construction. Table 11 shows the annual average of highway-related displacements during the period 1971-75. The level has declined from the **1960's,** when highway construction was at a peak. A part of this decline can also be attributed to Federal policies, notably uniform relocation assistance legislation and the National Environmental Policy Act, which have brought increased efforts to prevent or mitigate the disruptive effects of highways.

There are some members of society who cannot share fully in the mobility afforded by automobiles. Lack of access to an auto or lack of ability to use an auto is a particular problem for four segments of the population—the old, the poor, the handicapped, and the young. These segments of the population are sometimes called "transportation disadvantaged. "

Table 12 contains estimates of the size of the population groups in which lack of mobility is most prevalent. These estimates are given separately for adults and for the young (under 17) since many young people do not have independent travel needs. The young have been included for two reasons: to provide a complete account of those who lack the degree of mobility enjoyed by the rest of society and to indicate the extent to which children, who must rely on others for transportation, generate automobile travel demand.

Table 11 .—Annual Highway-Related Displacements

Type of displacement	Yearly average 1971-75
Residential	10,789
Business	2,510
Farm	209
Nonprofit organization	100

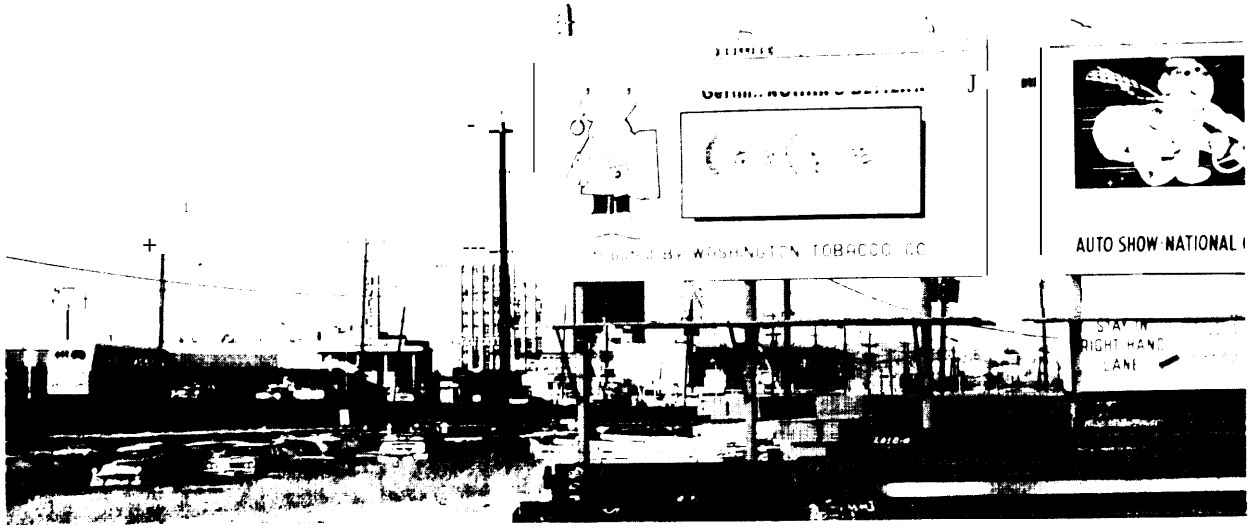
SOURCE: Sydec, using Federal Highway Administration Relocation Statistics reports

Table 12.—Transportation Disadvantaged Population* (millions)

	1970
Adults (over 17)	
Elderly (over 65, not poor, and not handicapped)	10.2
Poor (not handicapped)	9.9
Handicapped	17.1
Total adult disadvantaged	37.2
Total adult population	135.2
Percent of adult population	27.50/o
Young (17 and under)	
Handicapped	0.9
Not handicapped	68.8
Total young	69.7
Total population	204.9
Percent of total population	34.O%

*Figures are total estimated persons in each group and do not represent those who are known to be transportation disadvantaged.

SOURCES: Sydec estimates, based on *Transportation Requirements for the Handicapped, Elderly, and Economically Disadvantaged,* Transportation Research Board, Report No. 39, 1976, p. 11; HEW National Center for Health Statistics 1960 and 1970 Census of Population in *The Handicapped and Elderly Market for Urban Mass Transit* prepared by the Transportation Systems Center for the Urban Mass Transportation Administration, October 1973; and U.S. Census, Series II, Population Projections.



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