Chapter 7

SAFETY ISSUES, POLICIES, AND FINDINGS

Chapter 7.—SAFETY ISSUES, POLICIES, AND FINDINGS

LIST OF TABLES

LIST OF FIGURES

SAFETY ISSUES, POLICIES, AND FINDINGS

CHAPTER 7

SUMMARY

The current annual toll of motor vehicle crashes is almost 48,000 deaths and over 4 million injuries. The estimated monetary cost to society is approximately $44 billion, Despite existing Federal policies, regulations, and programs dealing with automobile and highway safety, and despite the introduction of new safety features, such as passive restraints, the annual toll is expected to keep rising, By **2000, there** could be as many as 64,000 deaths and over 5 million injuries annually.

The major aspects of the system that need to be addressed to improve safety are vehicle and highway design and driver behavior. All have been the subject of Federal highway and traffic safety policies and programs, and it appears that these efforts by the Federal Government have had a beneficial effect. The rate of fatalities per vehicle mile has been reduced nearly **40** percent in the past decade. In absolute numbers, however, the annual toll remains high and is expected to rise steadily in the coming years as the result of more cars on the road, more drivers, and more miles of travel, Additional policies and programs to stem the trend of increasing death and injury should be considered.

In the near term, safety benefits could be realized rapidly from policies to promote increased use of seat belts (passive restraints will not be in widespread use for many years) and to enforce adherence to the 55 mph speed limit. Potentially great benefits could also be achieved by measures to reduce the use of alcohol associated with driving.

In the long term, increased crashworthiness and improved occupant restraint systems are two aspects of vehicle design that could produce significant reductions in death and injury. For highways, the greatest benefits could be achieved by a general program to eliminate roadside hazards or to provide crash attenuation.

As a long-term strategy, the Federal Government may also wish to consider the policy of establishing a comprehensive set of specific and quantitative safety goals. This policy, analogous to those which established national goals for clean air and fuel economy, could provide the basis for planning, implementing, and evaluating individual safety measures. Safety goals could also provide for more effective coordination of Federal, State, and local programs and could help in determining the appropriate allocation of resources.

BACKGROUND

The safety of the automobile transportation system is a severe and long-standing problem. For many years, highway deaths have accounted for over 90 percent of all the transportation-related deaths in the country. In 1977, the toll on streets and highways amounted to 47,715 deaths and over 4.3 million injuries. The costs to society are estimated to be $44 billion annually. (See table **73.)**

In this century, approximately 2 million persons have died and nearly 100 million have been injured through the use of motor vehicles—a total that is more than 3 times the combat losses

Table 73.—1977 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
Van, pickup occupants	5,200
Motorcycle	4,100
Pedestrian & cyclists	8,600
Truck, bus, and other	2,400
Estimated cost [d]	$44billion

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

suffered by the United States in all wars.[1] The Nation's vehicles and highways claim more American lives each year than were lost in either the Korean or Southeast Asia Wars. On the average, a highway fatality occurs every 11 minutes and an injury every 9 seconds.

In 1975, motor vehicle crashes accounted for 2.4 percent of total reported deaths in the United States and ranked as the sixth leading cause of death. (See table 74.) Accidents of all kinds accounted for **103,000** deaths and 10.7 million injuries in 1975, and motor vehicle crashes represented approximately 45 percent of the total accidental deaths and 37 percent of the injuries. Measured in terms of working life lost, traffic deaths represent a social problem comparable to heart disease and cancer. (See figure 38.)

Table 74.—Leading Causes of Deaths for 1975

Causes	Number	Percent of Total
Diseases of the heart	716,215	37.8
Malignant neoplasms	365,693	19.3
Cerebrovascular disease	194,038	10.3
Other accidents	57,177	3.0
Pneumonia	51,387	2.7
Motor vehicle crashes	45,853	2.4

[a]If the category of "Other Accidents" were disaggregated, motor vehicle crashes would be the fifth-ranking cause of deaths and the leading cause of accidental death.
SOURCE: U.S. Department of Health, Education, and Welfare, National Center for Health Statistics, *Monthly Vital Statistics Report.*

Motor vehicle crashes are the leading cause of death in the 15 to 34 age group. About half of the yearly death toll consists of persons in that age bracket. As shown in figure 39, the proportion of young adults that die in traffic crashes far exceeds the relative size of this age group in the population as a whole.

Over the years, the general trend has been a continuing increase in the number of traffic fatalities. A high point of 56,000 deaths was reached in 1973. A sharp drop to 46,000 deaths occurred in 1974, due in part to the 55 mph speed limit and the temporary reduction in auto travel brought about by the gasoline shortage. Since then, the number of fatalities has risen again but still remains below the peak of 1973.

While the number of traffic deaths has grown over the years, the fatality rate (deaths per 100 million miles of vehicle travel) has steadily declined—from 18 per 100 million miles in 1925 to 3.25 per 100 million miles in 1977. Thus, while the death rate is decreasing, the steady rise in the number of autos and miles of travel has resulted in a growing number of traffic deaths. (See figure **40.)**

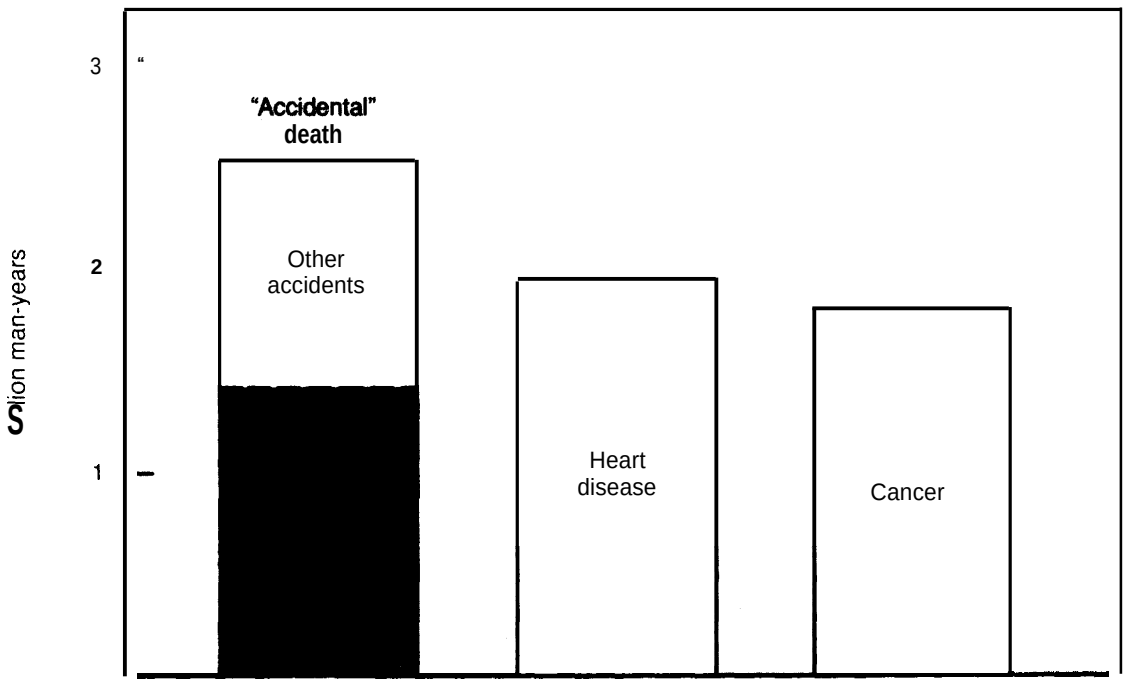
Traffic mortality on a population basis increased in the years 1960 to 1973, but declined in 1974, consistent with the sharp drop in fatalities. (See figure 41.) The traffic death rate per hundred thousand population has ranged from about 20 to 30 over the last five decades.

While the death rate per vehicle mile traveled is relatively low in this country, the death rate per 100,000 population is on the high side compared with other nations. Industrialized countries in general rank high in transportation mortality rates—with some exceptions, notably Japan, Great Britain, Sweden, and East Germany. (See table 75.)

When stated in terms of passenger miles of travel, as shown in table 76, the death rate for automobiles is among the highest of all modes of transportation. Automobile travel is considerably more dangerous than bus, rail, and airline travel, but a much safer form of transport than motorcycle and general aviation.

[1]National Safety Council, *Accident Facts, 1977* Edition,

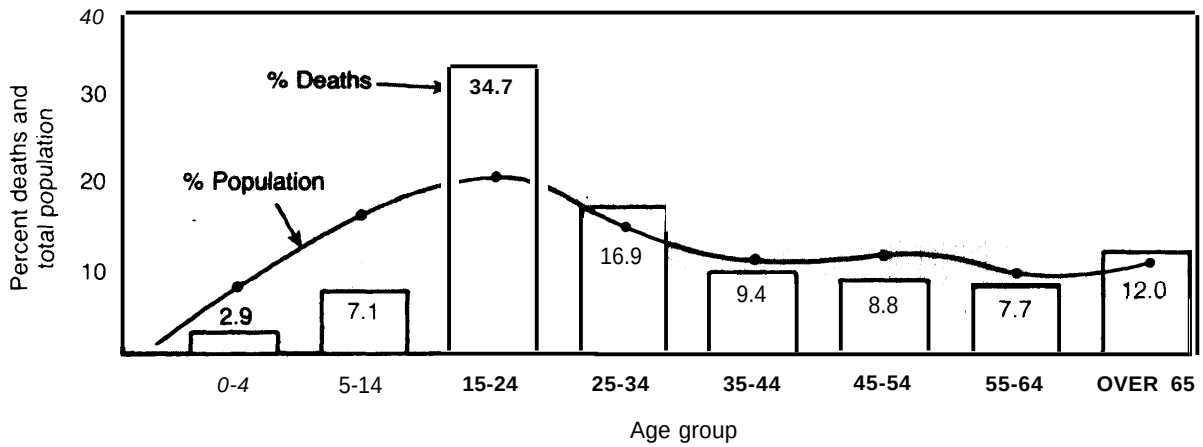
Figure 38.—1975 Loss of Working Life—Annual Man-Years[a]



SOURCE: Computed by the OTA from 1975 data from the National Center for Health Statistics.

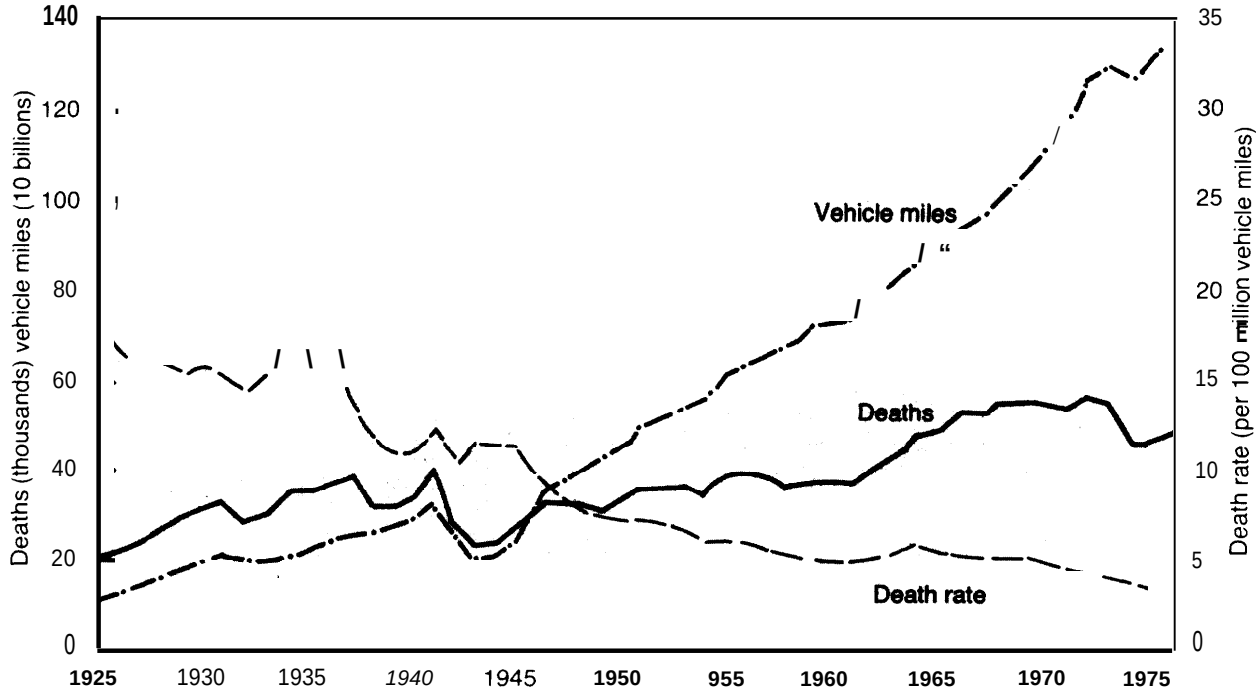
[a] Loss of working life is defined as the working years between the ages of 18 and 65 that are lost due to death before age 65

Figure 39.—Traffic Deaths by Age Groups



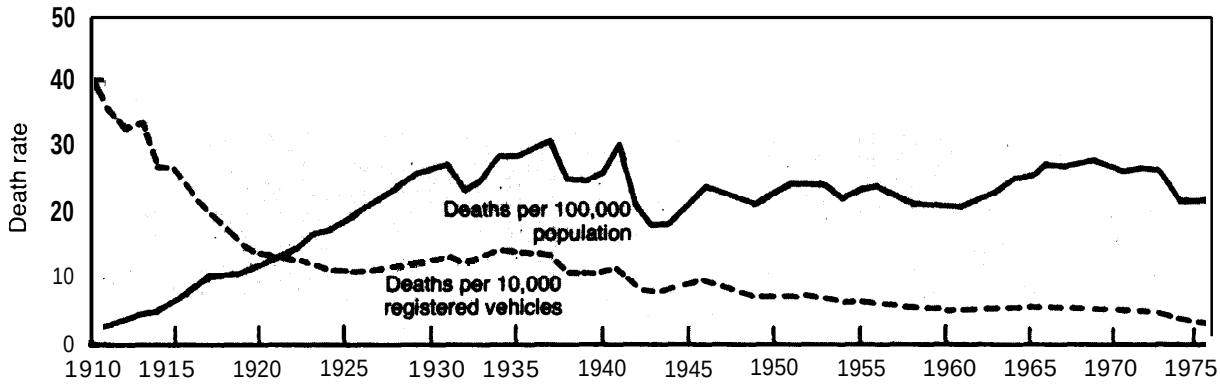
SOURCES: U.S. Department of Health, Education, and Welfare, National Center for Health Statistics, *Monthly Vital Statistics Report;*
U.S. Department of Commerce, Bureau of the Census, *Statistical Abstract of the United States: 1976,* 97th Edition

Figure 40.—Motor-Vehicle Travel, Deaths, and Death Rates



SOURCE: National Safety Council, *Accident Facts*,1978

Figure 41 .—Trends in Death Rates



SOURCE: National Safety Council, *Accident Facts*,1977

Table 75.—Motor Vehicle Deaths By Nations[a]

Nation	Year	Deaths	Deaths per 100,000 population
Chile	1974	1,115	11.1
Japan,	1975	14,206	12.8
England-Wales	1974	6,372	13.0
Norway	1974	549	13.8
Greece	1974	1,297	14.5
Sweden	1975	1,236	15.1
East Germany	1975	2,578	15.3
Mexico	1974	8,887[b]	15.3
Denmark	1975	849	16.8
Ireland	1974	562	18.2
Switzerland	1975	1,237	19.5
Israel	1974	563	19.8
Czechoslovakia	1973	2,958	20.3
United States	1974	46,402[b]	22.0
France	1974	11,786'	22.5
West Germany	1974	14,242	23.0
Canada	1974	6,325[b]	28.1
Australia	1974	3,816	28.6
Austria	1975	2,483	33.0
Portugal	1975	3,299	34.9

[a]In general, the data presented include deaths that occur within 30 days of the traffic crash. Other time periods are noted as follows. [b]One year (the total deaths are about 2 percent greater than if 30 days is used). [c]Three days (reduces the total number of deaths compared with 30 days).
SOURCE: National Safety Council, *Accident Facts*.

Table76.— Estimates of Death Rate for Transportation Modes in the United States

Type of travel	Deaths per 100 million passenger miles[a]
Commercial aviation	0.1
Passenger train	0.1
Rail rapid transit	0.1
Bus	0.2
Automobile	1.4
Motorcycle	13.0
General aviation	13.0

[a]Includes only persons traveling by this means of transportation. Data sources range in the period 1974-76.
SOURCE: William Haddon, Jr., and Susan P. Baker, *Injury Control*, Insurance Institute for Highway Safety, March 1978.

TRAFFIC CRASH DATA

Traffic crash data are collected by the States (through police accident reporting), insurance companies, the U.S. Public Health Service, the U.S. Department of Transportation (DOT), and various research organizations. The U, S. DOT Fatal Accident Reporting System is currently considered the most reliable source of data on traffic fatalities. For injuries and property damage, national estimates are not based on actual totals but on reports from individual States. The National Accident Sampling System (NASS), a program recently begun at DOT, should greatly improve the accuracy of injury and property damage data in the years ahead.

The following sections summarize the data available on traffic crashes, deaths, and injuries.

Crashes

The National Safety Council (NSC) estimated that in 1976 there were 16,800,000 motor vehicle crashes involving 28,400,000 motor vehicles. (OTA estimates for **1977,** based on the 1976 figures, are 17,600,000 crashes involving 29,800,000 vehicles.) About 93 percent of those crashes were relatively minor, involving property damage and nondisabling injury. [z] Table 77 shows a breakdown, by vehicle type, of vehicles involved in these crashes. The data indicate that one out of every five vehicles was involved in some type of collision in 1976.

Deaths

Data from the DOT Fatal Accident Reporting System are shown in table 78 for the years 1975 to 1977.

The majority (73 percent) of the 47,715 persons killed in traffic crashes in 1977 were vehicle occupants—27,353 in automobiles and 5,222 in pickups or vans. From 1975 to 1977, the largest increases in fatalities were from crashes involving heavy trucks (33.1 percent), motorcycles (28 percent), and pickups/vans (20.5 percent). There was a 4.1-percent increase in automobile fatalities and a 7.2-percent increase in total highway fatalities. Pedestrian and cyclist deaths averaged over 8,000 annually for these 3 years.

Other statistics that indicate the nature and distribution of fatal traffic crashes are:

- Males constitute 54 percent of the drivers but account for 70 percent of the driving, over 70 percent of all fatalities, and 82 percent of all drivers involved in fatal crashes.
- On Friday, Saturday, and Sunday between the hours of 4 p.m. and 4 a.m., the frequency of fatal crashes is the highest. The period from 4 a.m. to 8 a.m. accounts for the fewest fatalities throughout the week.
- Over half of vehicle occupant fatalities are the result of frontal impacts. (See figure 42.)
- For single-vehicle crashes, collision with a fixed object is most prevalent.
- The ratio of fatalities to occupants in multivehicle crashes is 2 times higher in small cars than in large cars. For single-vehicle crashes, the ratio is the same for all vehicle sizes.
- Approximately 35 percent of the fatalities occur in urban areas and **65** percent in rural areas.
- About 37 percent of urban fatalities are pedestrians, compared to 8 percent in rural areas.
- Half of the pedestrian and bicycle deaths are persons under 14 or over **65.**

[z] A disabling injury is one which causes permanent or temporary disability for longer than 24 hours. All other injuries are classified as nondisabling.

Table 77.—Crash Data by Vehicle Type, 1976

Type of vehicle	Vehicles in all crashes		Percent of vehicle registrations	Percent of registered vehicles in crashes[a]
	Number	Percent		
Total	28,400,000	100.0	100.0	19.9
Automobile	23,280,000	81.9	77,1	21.2
Motorcycle[b]	402,000	1.5	3.6	7.8
Buses	235,000	0.8	**0.3**	**55.0**
Trucks	4,100,000	14.5	19.0	15.2
Other[d]	383,000	1.3	(e)	(e)

[a] Computations based on the NSC figure of 142,400,000 vehicle registrations in 1976
[b] Includes taxicabs.
[c] Includes motorscooters and motorbikes.
[d] Includes farm equipment, fire equipment, ambulances, and other.
[e] This category not included in vehicle registrations.
SOURCE: National Safety Council, *Accidental Facts.*

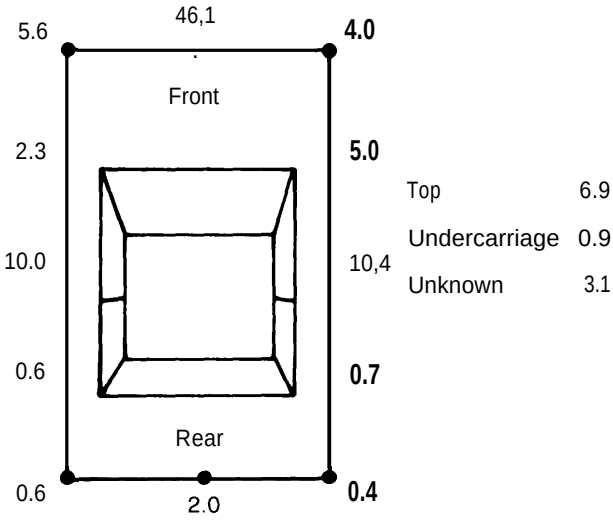
Table 78.—Fatal Crashes 1975-77 Number of Persons, Crashes, Vehicles, and Fatalities by Vehicle Type

	Persons				Crashes			
	1975	1976	1977	% Change '75-'77	1975	1976	1977	% Change '75-'77
Total	05,149	105,870	111,043	5.6	39,160	39,747	42,064	7.4
Automobile	69,292	68,442	70,772	2.1	*30,122*	29,967	'31 .285	3.9
Motorcycle	4.040	4,168	5,147	27,4	*3,148*	3,245	4,011	27.4
Buses	1,043	1,126	1,149	10.2	323	318	318	(1 .5)
Pickup/van	13,211	14,372	15,360	16.3	7,335	7,966	8,658	18,0
Heavy trucks	3,545	4,162	4,590	29.5	2,858	3,380	3,774	32.0
Other trucks	2,018	1,716	1,960	(2.9)	1,406	1,252	1,460	3.8
Other	2,447	2,504	2,421	(1 .1)	1,357	1,334	1,362	0.4
Pedestrian	8,253	8,135	8,476	2.7	7,420	7,343	7,592	2.3
Pedal cyclist	1,058	979	998	(5.7)	993	902	916	(7.8)
Other nonoccupant	242	266	220	(9.1)	155	139	135	(1 2.9)

	Vehicles				Fatalities			
	1975	1976	1977	% Change '75-'77	1975	1976	1977	% Change '75-'77
Total	55,535-	56,084	60,302	*8.6*	44,524	45,523	47,715	7.2
Automobile	38,330-	37,795	39,781	*3.8*	26,268	26,647	27,353	4.1
Motorcycle	3,265	3,343	4,143	*26.9*	3,189	3,312	4,083	28.0
Buses	327	319	318	*(2.8)*	53	73	41	(22,6)
Pickup/van	7,692	8,370	9,125	*18.6*	4,332	4,893	5,222	20.5
Heavy trucks	3,042	3.566	3,998	*31.4*	717	862	954	33.1
Other trucks	1,447	1,273	1,487	*2.8*	428	378	444	3.7
Other	1,432	1,418	1,450	*1.3*	937	937	926	(1 .2)
Pedestrian	—	—	—	—	7,516	7,427	7,705	2.0
Pedal cyclist	—	—	—	—	1,003	914	916	(8,7)
Other nonoccupant	—	—	—	—	81	80	71	(1 2,3)

SOURCE Fatal Accident Reporting System data, U S Department of Transportation, National Highway Traffic Safety Administration. Office of Statistics and Analysis

Figure 42.—Percent Distribution of Fatalities by Principal Impact Point



SOURCE Derived from U S Department of Transportation, National Highway Safety Administration, *Fatal Accident Reporting System 7976 Annual Report* November 1977

- Heavy trucks represent less than 1 percent of the vehicle fleet, but they are involved in 9 percent of the fatal crashes.[3]
- In collisions between cars and large trucks, the occupants of the car are 14 times more likely to be killed than the truck occupants.[4]

Injury

Motor vehicle injury data are not as reliable as the information on fatalities. There are several sources of injury data, each using somewhat different classifications for injury. The National Safety Council defines an injury as that which results in some degree of impairment or renders a person unable to perform regular duties or activities for a full day beyond the day of the injury (a disabling injury). The National Health Survey of the U.S. Public Health Service classifies injuries in the following categories:

- Medically Attended. —A physician was consulted (in person or by telephone) for treatment or advice within 2 weeks of the injury.
- Activity Restriction.—Causes a person to cut down on usual activities for 1 full day (does not require complete inactivity).
- Bed Disabling. —Confines a person to bed for more than one-half of the daylight hours on the day of the injury or some following day.

In 1971, the American Medical Association's Committee on Medical Aspects of Automotive Safety published the Abbreviated Injury Scale (AIS), which provides a detailed identification of the severity of injuries. The general AIS classification is:

Code	*Category*
0	No Injury
1	Minor
2	Moderate
3	Severe (Not Life-Threatening)
4	Serious (Life-Threatening, Survival Probable)
5	Critical (Survival Uncertain)
6	Maximum (Currently Untreatable)
9	Unknown

A more detailed description of the Code 3 injuries is shown in table 79 for illustrative purposes.

The 1975 injury data from the U.S. Public Health Service, the National Safety Council, and the Department of Transportation are compared in table 80. The data indicate that in 1975 about 4,000,000 persons were injured in motor vehicle crashes, and that as many as 150,000 were left with permanent physical impairment.

The U.S. Public Health Service estimated there were 5,033,000 motor vehicle injuries in 1977, 4,392,000 of which were traffic-related. (See table 81.) The National Safety Council estimates there were 1,900,000 traffic-related disabling injuries in 1977.[5]

cost

A traffic crash results in loss both to the individuals involved and to society **at large. Sev**eral efforts have been made to quantify these monetary losses. No attempt has been made to

[3]Robert Sherrill, "Raising Hell on the Highways," *New York Times Magazine*. Nov. 27, 1977, pp. 38-102.
[4]Ibid.
[5]National Safety Council, Accident Facts, 1978 preliminary condensed edition, February 1978.

Photo Credit. Insurance Institute for Highway Safety

Table 79.—Abbreviated Injury Scale Severity Code 3: Severe (Not Life-Threatening)

General external	Head & Neck	Chest & thoracic spine	Abdomen & lumbar spine	Extremity and/or pelvic girdle
Laceration Involving major nerves and/or vessels	Cerebral concussion with or without skull fracture, unconsciousness more than 15 minutes, no other neurological signs.	Thoracic cavity Injury with unilateral hemothorax or pneumothorax.	Abdominal organ contusion.	Displaced, comrnlnuted and/ or open fracture of long bone, hand, or foot.
2" or30 burns (21 % - 30% body surface)	Cerebral concussion with displaced or depressed skull fracture, unconsciousness less than 15 minutes, no other neurological signs.	Lung contusion.	Extraperitoneal bladder rupture.	Displaced pelvic fracture with or without dislocation,
	Avulsion of eye or optic nerve	Thoracic spine fracture without neurological Involvement (excluding minor compression fracture).	Diaphragm rupture,	Major joint dislocation
	Open and/or displaced facial bone fracture or fracture with antral or orbital Involvement.	Multiple rib (2 or more) fracture with - out flail chest,	Stomach, mesentary, or urethra superficial laceration	
	Cervical spine fracture and/or dislocation (C-4 or below) without cord damage		Ureter avulsion.	
			Lumbar spine fracture without neurological Involvement (ex. cluding minor compress ion fracture).	

SOURCE American Associatlon of Automotive Mediclne The *Abbreviated Injury Scale (AIS)* 1976 *revlslon*

Table 80.—Motor Vehicle Injuries, 1975

National Safety Council		U.S. Public Health Service		U.S. Department of Transportation	
Category	Number	Category	Number	Category (A IS Code)	Number
Permanent disabling	150,000	Without activity restriction	1,448,000		
Temporary disabling	1,650,000	With activity restriction	1,364,000	1	3,400,000
				2	492,000
		Bed disabling	1,647,000	3	80,000
				4	20,000
				5	4,000
Total disabling injuries	1,800,000	Total injuries	4,459,000	Total injuries	3,996,000

SOURCES: National Safety Council data *Accident Facts*, 1976 Edition; U.S. Public Health Service data from National Safety Council, *Accident Facts*, 1977 Edition, for the "Motor Vehicle (Moving)" category; U.S. Department of Transportation data, National Highway Traffic Safety Administration, *1975 Societal Costs of Motor Vehicle Accidents*, DOT HS 802119, December 1976.

Table 81.—Injuries in the United States, 1977

Total injury	73,927,000
Motor vehicle (moving)	5,033,000
Traffic	4,392,000
Work	11,414,000
Home	29,588,000
Other	31,435,000

SOURCE U S Department of Health, Education, and Welfare, Public Health Service, National Center for Health Statistics

quantify the human suffering, pain, loss of relationships, and other psychological factors associated with traffic crashes. The Department of Transportation has estimated traffic crash losses in terms of: 1) resources consumed in treating personal injury and repairing vehicular damage that otherwise could be shifted in the long run to welfare-producing activities, and 2) losses in production and the ability to produce.

Table 82 shows these costs and their estimated value (in 1977 dollars). Multiplying these cost components by the number of injuries in the AIS code levels shown in table 79 and the 1977 total deaths results in an estimated cost of $43.9 billion, which includes the property damage associated with traffic crashes. (See table 82.)

The National Safety Council estimates of the costs of traffic crashes for 1976 are shown in table 83. There is considerable difference between the NSC and DOT estimates, both in the cost categories included in the totals and in the costs within similar categories.

Table 82.—Estimated Cost of Traffic Crashes in 1977 (1977 dollars)

Cost component	Injury severity (AIS)							Totals
	6	5	4	3	2	1	PDO[a]	$ Billions
Production/consumption								
Market	$244,480[b]	$146,180[b]	$64,115[b]	$,900	$1,000	$75	—	$14.43
Home, family, and community	73,345[b]	43,855[b]	19,230[b]	490	355	25	—	4.36
Medical:								
Hospital	340	7,130	2,790	1,360	560	55	—	0.67
Physician and other	195	6,710	2,625	640	200	65	—	0.46
Coroner-medical examiner	155			—	—	—	—	0.01
Rehabilitation	—	7,295	3,650	—	—	—	—	0.10
Funeral	1,000[b]	—	—	—	—	—	—	0.05
Legal and court	2,490	1,870	1,240	875	170	160	8	1.02
Insurance administration	425	425	410	345	320	75	45	1.46
Accident investigation	90	90	80	50	40	30	7	0.29
Losses to others	4,255	4,825	2,110	300	150	35	—	0.48
Vehicle damage	4,600	4,600	4,365	3,365	2,150	1,840	360	15.79
Traffic delay	90	70	70	185	185	185	185	4.79
Total	$331,465	$223,050	$100,885	$9,510	$5,130	$2,545	$605	
Number of occurrences[c]	47,715	4,000	20,000	80,000	492,000	3,400,000	21,900,000	
Total cost in billions of dollars	$15.82	$0.89	$2.02	$0.76	$2.52	$8.65	$13.25	$43.91

[a]Property damage only.
[b]7-percent discount rate.
[c]1977 fatality figure report from DOT, FARS data. Injury and property damage figures from original source material.
SOURCE: U.S. Department of Transportation, National Highway Traffic Safety Administration, *1975 Societal Costs of Motor Vehicle Accidents*, DOT HS 802119, December 1976 and updated data.

Table 83.—National Safety Council Summary of Motor Vehicle Accident Costs in 1976

	Billions of dollars
Wage loss	$ 7.6
Medical expenses	2.1
Insurance administration	6.1
Property damage	8.9
Total	$24.7

SOURCE: National Safety Council, *Accident Facts*.

PRESENT POLICY

The earliest Federal Government response to the highway safety problem was in 1924, when Secretary of Commerce Herbert Hoover brought together a group of experts at the First National Conference on Street and Highway Safety. The conference addressed such matters as traffic control, construction and engineering, education, and motor vehicle design. Five additional conferences were held in the years through 1950, but no specific role for the Federal Government evolved from these efforts.

In the years following 1950, however, a more intense interest in highway safety was displayed by Congress and the executive branch. In 1954, President Eisenhower convened a White House Conference on Highway Safety and created a President's Committee for Highway Safety. The Federal Aid Highway Act of 1956 authorized the Secretary of Commerce to investigate thoroughly the Federal role in highway safety. A report of that investigation, submitted in 1959, became the basis for significant change in the Federal Government's involvement in highway safety.

Noting the increasing fatalities and injuries on the Nation's highways, President Johnson stated in his March 2, 1966, transportation message to Congress that:

> Neither private industry nor government officials concerned with automotive transportation have made safety first among their priorities. Yet we know that expensive freeways, powerful engines, and smooth exteriors will not stop the massacre on our roads.[6]

The first major Federal effort in highway safety began with the passage of the National Traffic and Motor Vehicle Safety Act of 1966 (Public Law 89-563) and the Highway Safety Act of 1966 (Public Law 89-564). This legislation called for Federal involvement in three major areas:

1. Federal safety standards for new vehicles,
2. Safety defect recall campaigns, and
3. State and local highway safety programs.

These laws directly affected the automobile industry, State and local governments, and highway users.

Motor Vehicle Safety Standards

The most important and controversial feature of Federal involvement in highway safety is the Federal Motor Vehicle Safety Standards (FMVSS). Under this program (summarized in table 84), new vehicles and vehicle components must comply with certain performance requirements before they can be sold to the public. These standards have been shown to have made a contribution to the reduction in fatality and injury rates on highways since 1966. A recent General Accounting Office study estimated that the standards might have saved as many as 28,000 lives between 1966 and 1974.[7]

In addition to about 50 Federal safety standards now in force for passenger cars, the National Highway Traffic Safety Administration (NHTSA) has indicated its intention to extend certain standards to include light trucks and to upgrade existing standards or issue new ones for passenger cars. These proposed new and revised standards are listed in table 85.

Safety Defect Recall Campaigns

NHTSA has an aggressive vehicle defect and recall program. In the period 1966 to 1975, 52.4 million vehicles were recalled. This amounted to 43 percent of the vehicles produced during that time.[a]

The effectiveness of this massive recall effort in improving vehicle safety has not been determined. For example, it is unknown at this time how many of the 52.4 million vehicles recalled were actually brought in for repair or replacement of defective components.

---

[6] U.S. Congress, Senate, *Highway Safety Act of 1966*, Senate Report 1302, 89th Cong., 2d sess., June 23, 1966, p. 2743.

[7] *Effectiveness, Benefits, and Costs of Federal Safety Standards for Protection of Passenger Car Occupants*, Report to the Committee on Commerce, U.S. Senate, by the Comptroller General of the United States, CED-76-121, July 7, 1976.

[a] U.S. Department of Transportation, National Highway Traffic Safety Administration, *Traffic Safety '76*, DOT HS-802 427.

Table 84.—Chronology of Federal Motor Vehicle Safety Standards and Regulations

Date Issued	Standard	
January 31, 1967.	Standard No 101–	Control Location. Identification, and Illumination
	Standard No, 102	Transmission Shift Lever Sequence, Starter Interlock, Transmission Braking Effect
	Standard No. 103	Windshield Defrosting and Defogging
	Standard No 104	Windshield Wiping and Washing Systems
	Standard No 105	Hydraulic Brake Systems
	Standard No. 106	Brake Hoses
	Standard No 107	Reflecting Surfaces (Chrome Trim)
	Standard No. 108	Lamps, Reflective Devices, and Associated Equipment
	Standard No. 111	Rearview Mirrors
	Standard No, 201	Occupant Protection In Interior Impact
	Standard No 203	Impact Protection for the Driver from the Steering Control System
	Standard No, 204	Steering Control Rearward Displacement
	Standard No. 205	Glazing Materials (Automobile Windshield Glass)
	Standard No 206	Door Locks and Door Retention Components
	Standard No. 207	Seating Systems
	Standard No 208	Occupant Crash Protection
	Standard No 209	Seat Belt Assembles
	Standard No 210	Seat Belt Assembly Anchorages
	Standard No 211	Wheel Nuts, Wheel Discs, and Hub Caps
	Standard No. 301	Fuel System Integrity
November 8, 1967.	Standard No 109	New Pneumatic Tires
	Standard No. 110	Tire Select ton and Rims
February 12, 1968.	Standard No 202	l-lead Restraints
April 24, 1968 .,	Standard No, 112	Headlamp Concealment Devices
	Standard No 113	Hood Latch Systems
	Standard No. 114	Theft Protection
July 3,1968	Standard No. 115	Vehicle Identification Numbers
August 13, 1968"	Standard No. 212	Windshield Mounting
December 24, 1968.	Standard No. 116	Motor Vehicle Brake Fluids
January 17, 1969	Part No. 567	Certification Regulation
	Part No. 569	Regrooved Tires
March 23, 1970 ., .,	Standard No, 213	Child Seating Systems
July 17.1970	Standard No. 118	Power-Operated Window Systems
October 22, 1970.	Standard No 214	Side Door Strength
November 5, 1970. ,	Part No 574	Tire Identification and Record keeping
December 31, 1970.	Standard No 302	Flammability of Interior Materials
February 10, 1971	Part 573	Defect Reports
February 19, 1971	Standard No. 121	Air Brake Systems
April 9, 1971.	Standard No 215	Exterior Protect Ion (Bumpers)
April 14, 1971.	Standard No. 117	Retreaded Pneumatic Tires
December 3, 1971'	Standard No. 216	Roof Crush Resistance
March 1, 1972.	Standard No 122	Motorcycle Brake Systems
	Standard No, 125	Warning Devices
March 31, 1972	Standard No 124	Accelerator Control Systems
April 4, 1972.	Standard No, 123	Motorcycle Controls and Displays
May 3.1972	Standard No 217	Bus Window Retention and Release
August 3, 1972	Standard No.126	Truck-Camper Loading
January 17, 1973	Part No. 577	Defect Notifications
January 22, 1973	Part No 555	Temporary Exemptions from Federal Motor Vehicle Safety Standards
January 31, 1973. .	Part No. 580	Odometer Disclosure Requirements
July 26, 1973 .,	Part No. 572	Anthropomorphic Test Dummy
August 9, 1973	Standard No. 218	Motorcycle Helmets
November 5, 1973	Standard No 119	New Pneumatic Tires
May 20, 1975	Part No 575	Consumer Information—Uniform Tire Quality Grading
June 9, 1975.	Standard No 219	Windshield Zone Intrusion
September, 1975	Part No 552	Petitions for rulemaking, Defect and Noncompliance Orders
	Part No 570	Vehicles in Use Inspect Ion Standards
January 19, 1976	Standard No, 120	Tire Selection and Rims for Vehicles Other Than Passenger Cars
January 22, 1976.	Standard 220	School Bus Rollover Protection
	Standard No. 221	School Bus Body Joint Strength
	Standard No. 222	School Bus Seating and Crash Protection
February 27, 1976	Part 581	Bumper Standard (Incorporates Standard 215)

SOURCE U S Department of Transportation, National Highway Traffic Safety Administration, *Traffic Safety '76*

Table 85.—Federal Motor Vehicle Safety Standards, Near-Term Improvements Under Consideration for Passenger Vehicles

Current standards	Inclusion of light trucks[a]	Upgrading of standards
FMVSS No. 201 —Occupant Protection in Interior Impact	x x	
FMVSS No. 203—impact Protection for the Driver from the Steering Control Systems	x x	x
FMVSS No. 204—Steering Control Rearward Displacement	x x	x
FMVSS No. 208—Occupant Crash Protection	x x	x[b]
FMVSS No. 213—Child Restraint Systems		x
FMVSS No. 214—Side Door Strength	x x	x
FMVSS No. 101 —Control Location, Identification, and illumination	x x	x
FMVSS No. 105—Hydraulic Service Brake, Emergency Brake, and Parking Brake Systems	x x[c]	
FMVSS No. 108—Lamps, Reflective Devices, and Associated Equipment	x x'	x
FMVSS No. 109— New Pneumatic Tires	(d)	X
FMVSS No. 11 1—Rearview Mirrors	x	x
FMVSS No. 114—Theft Protection	x x	x
FMVSS No. 115—Vehicle Identification		x
New **Proposed Standards'**		
Exterior Protrusions (minimize)		
Truck Rear Underride Guard (heavy trucks)		
Low Tire Pressure Warning		
Direct Fields of View		
Handling and Stability Performance Requirements		
Brake System Inspectability		
Speedometers/Odometers (limit speed indication)		

[a]Items marked X already apply; marked XX are intended to apply
[b]Upgrading quality of active seat belts prior to passive restraint requirement
[c]Will be extended to all motor vehicles (except motorcycles)
[d]For passenger car tires, many of which are used on light trucks
[e]Vehicle applicability not always specified
SOURCE: U.S. Department of Transportation, National Highway Traffic Safety Administration, 'Five Year Plan for Motor Vehicle Safety and Fuel Economy Rulemaking and Invitation for Applications for Financial Assistance Federal Register 43: 11100-11107, Docket No. 78-07; Notice 1, Jan. 14, 1978

State and Local Highway Safety Programs

Federal involvement in highway safety at State and local levels before 1966 was limited. States were permitted to spend some Federal-Aid Highway funds for safety projects related to highway and traffic engineering, but not for driver safety programs or other safety features of the system.

The Highway Safety Act of 1966 mandated that the Secretary of Transportation issue safety standards to be implemented by the States. The law also provided for Federal matching grants to assist States in implementing the standards and provided for withholding of Federal-Aid Highway funds (up to 10 percent) if a State failed to comply with a standard.

The Department of Transportation issued 18 standards under this act. (See table 86.) Compliance by the States has varied; in some cases, noncompliance has persisted for long periods. When DOT decided to impose sanctions, Congress, in the Highway Safety Act of 1976, placed a moratorium on sanctions and directed the Secretary to study the "adequacy and appropriateness of the standards" and report the findings by July 1, 1977.

The DOT report prepared pursuant to this direction by Congress stated that "Federal standards are generally adequate, in that they incorporate countermeasures which are believed

to ultimately reduce accidents. "[9] DOT recommended "that mandatory compliance with each of the present 18 standards no longer be required." In certain critical areas, however, DOT stated that national conformity should still be required and that the pertinent standards should be maintained.

Legislation to this effect was proposed by the Carter Administration, but was rejected by Congress. However, the Highway Safety Act of 1978 does grant limited waivers regarding the 18 standards for States with approved alternate highway safety programs.

[9] U.S. Department of Transportation, National Highway Traffic Safety Administration, *An Evaluation of the Highway Safety Program. A Report to the Congress from the Secretary of Transportation*, July 1, 1977.

[10] U.S. House of Representatives, 95th Congress, *Surface Transportation Assistance Act of 1978*, Conference Report No. 95-1797, Oct. 14, 1978.

Table 86.— Federal Highway Safety Program Standards

Standard No. l—Periodic Motor Vehicle Inspection (NHTSA): To increase the likelihood that every vehicle operated on the public highways is properly equipped and is being maintained in safe operating order.

Standard No. 2—Motor Vehicle Registration (NHTSA): To provide a means of identifying the owner and the type, weight, size, and carrying capacity of all vehicles licensed to operate i n the State.

Standard No. 3—Motorcycle Safety (NHTSA): To ensure that motorcycles, motorcyclists, and their passengers meet standards that contribute to safe operation and protection from injuries.

Standard No. 4—Driver Education (NHTSA): To ensure that every eligible high school student has the opportunity to enroll in a course of instruction designed to train him to drive skillfully and as safely as possible, under all traffic and roadway conditions.

Standard No. 5—Driver Licensing (NHTSA): To improve the quality of driving by requiring more effective and uniform licensing procedures.

Standard No. 6—Codes and Laws (NHTSA): To eliminate all major variations in traffic codes, laws, and ordinances on given aspects of highway safety, among political subdivisions in a State, and to further the adoption of appropriate sections of the Uniform Vehicle Code.

Standard No. 7— Traffic Courts (NHTSA): To provide prompt, impartial adjudication of proceedings involving motor vehicle and traffic laws.

Standard No. 8—Alcohol in Relation to Highway Safety (NHTSA): To broaden the scope and number of activities directed toward reducing traffic accidents arising in whole or in part from persons driving under the influence of alcohol.

Standard No. 9—identification and Surveillance of Accident Locations (FHWA): To identify specific highway locations which have high or potentially high accident experience, as a basis for establishing priorities for improvements to eliminate or reduce the hazards.

Standard No. 10—Traffic Records (NHTSA): To improve the quality of traffic records systems, to include and have readily available all data necessary to the operating agencies responsible for highway safety.

Standard No. 1 l—Emergency Medical Services (NHTSA): To provide an emergency care system for quick identification and response to accident injuries, to sustain life through first aid, and to coordinate the transportation and communications necessary to bring together the injured and definitive medical care i n the shortest possible time.

Standard No. 12—Highway Design, Construction, and Maintenance (FHWA): To maintain existing streets in a condition to promote safety, to modernize or build new roads to meet safety standards, and to protect motorists from accidents at construction sites.

Standard No. 13—Traffic Engineering Services (formerly Traffic Control Devices) (FHWA): To assure application of modern traffic engineering principles and uniform standards for traffic control.

Standard No. 14—Pedestrian Safety (NHTSA and FHWA); To emphasize the recognition of pedestrian and pedal cyclist safety as an integral, constant, and important element in community planning, and to ensure continuing programs to improve such safety.

Standard No. 15—Police Traffic Services (NHTSA): To improve police traffic services in all aspects of accident prevention. and to bring errant drivers to justice.

Standard No. 16—Debris Hazard Control and C/can-up (NHTSA): To provide for the planning, training, coordination, and communication needed to assure prompt correction of conditions that constitute potential traffic dangers.

Standard No. 17—Pupil Transportation Safety (NHTSA): To reduce the danger of death or injury to school children being transported to and from school, by setting requirements for safe equipment and its maintenance, and for training and supervision of drivers and maintenance personnel.

Standard No. 18—Accident Investigation and Reporting (NHTSA): To establish a uniform, comprehensible, accident investigation program to gather information on traffic accidents and enter it into the traffic records system for use in furthering highway safety.

SOURCE U S Department of Transportation National Highway Traffic Safety Adminitration, Traffic Safety 76

Other Related Policies

Under the Motor Vehicle Information and Cost Savings Act of 1972 (Public Law 92-513), NHTSA was directed to determine crash susceptibility, crashworthiness, associated insurance costs, and ease of diagnosis and repair of mechanical and electrical problems for automobiles. The information must be made known to the public for each make and model of car. Also included under this legislation is the "bumper standard" (Part 581 of the Act). The "no-damage" requirement is intended primarily to save consumers monetary loss associated with low-speed collisions, but there may also be marginal safety benefits that accrue. Except for Part 581, the provisions of this Act have not yet been implemented by NHTSA.

There are also safety benefits associated with other policies not specifically directed at safety. Prominent among these are:

- New highway construction and reconstruction under the Federal-Aid Highway Act and the growing use of the Interstate System during the past 10 years. These roads are built to very high safety standards and have fatality rates significantly lower than local roads built to lower standards.
- The 55 mph national speed limit, originally enacted as an energy conservation measure, appears to have brought safety benefits as well. Retention and enforcement of the 55 mph speed limit is now justified by many experts on both safety and energy conservation grounds.

PROJECTIONS

While the rate of fatal crashes per vehicle mile has steadily decreased over the past 50 years, the number of crashes—and the resulting death and injury—has been growing just as steadily, largely because there have been more drivers, more vehicles, and more miles traveled. Projections of highway fatalities and injuries to 2000 are influenced by several factors that may increase the severity and magnitude of the future traffic safety problem:

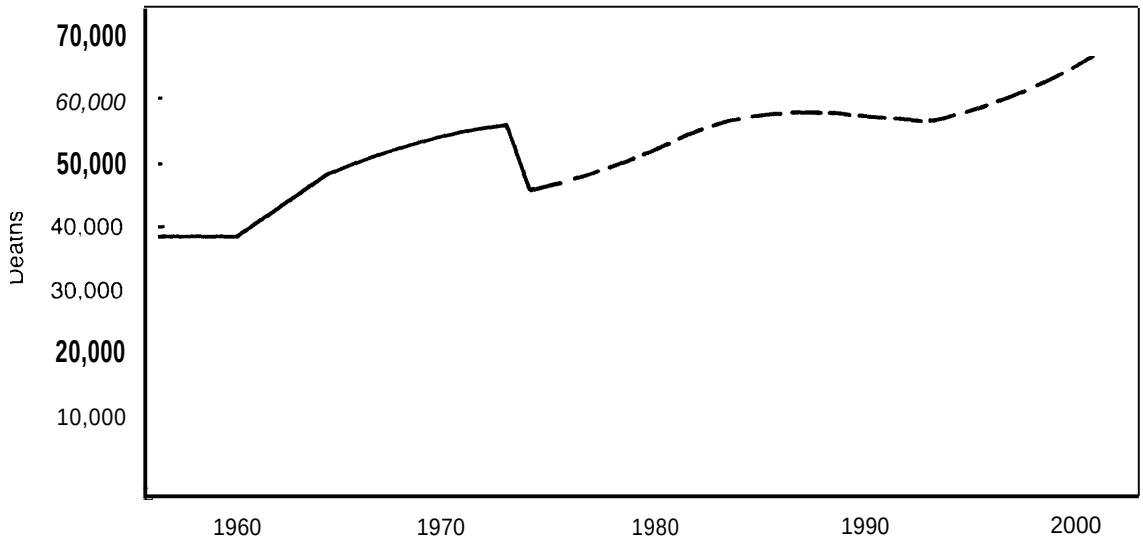
- VMT are expected to keep rising, as will the number of vehicles and drivers.
- The average size and weight of the automobile fleet are expected to decline.
- The percentage of trucks in the fleet and truck VMT are expected to increase.
- Highways are deteriorating at a rate faster than they are being maintained. Unless maintenance is emphasized, the condition of roads could contribute to an increase in crashes.

Other factors are expected to have a countervailing effect:

- The use of passive restraints will reduce vehicle occupant deaths and injuries.
- Changes in the age distribution of drivers—fewer younger drivers and more female drivers—may tend to lower the fatal crash rate. On the other hand, more drivers over the age of 65 may adversely affect the fatal crash rate.
- The proportion of vehicles equipped to meet present safety standards will increase.

Estimates based on these factors indicate that crashes, injuries, and fatalities will increase in the years to come. By 2000, it is projected that there will be approximately 64,000 deaths and over 5 million injuries annually. The total traffic deaths from 1977 to 2000 will exceed 1 million and injuries could reach as high as 130 million. (See figure 43.)

Figure 43.—Motor Vehicle Deaths, 1955 to 2000



SOURCE OTA propctlon using Base Case VMT adjusted for total vehicle travel

ISSUES AND POLICIES

In the last century technology has changed radically the way people live and the way they die. Infectious disease as a cause of death has virtually been eliminated. A child born in the United States today can look forward to a life untroubled by common diseases such as smallpox, scarlet fever, diphtheria, tuberculosis, typhoid fever, and polio, which were major causes of death a few generations ago.[11] Today, however, that same child is confronted with the prospect that from age 1 to 39, he or she is more likely to die in a motor vehicle crash than in any other manner.

Traffic safety is a modern sociotechnical problem, created by the interaction of humans, highways, and motor vehicles. Improvements in traffic safety will depend on adjustments or changes in the vehicles, in highways, and in the way people use them. The issues and policies considered in this study revolve around these changes.

Issues

In the course of this assessment, eight safety issues were identified and examined. These issues address the level of Federal involvement in safety, the priorities and allocation of safety activities, the application of safety technology, the methodologies used to select and evaluate safety strategies, and the distribution of safety costs. The issues are presented in table 87.[13] They have been developed to guide the formulation and evaluation of policy alternatives, and the identification of potential policy impacts.

The issues that address the role of the Federal Government in traffic safety, the level of involvement, and the questions of establishing priorities for safety strategies have been the subject of intense debate over the years, and this debate is unlikely to subside. Many considerations bear on these issues:

- the severity of the problem,

[11] John Cairns, "The Cancer Problem," *Scientific American* Volume 233, November 1975, pp. 64-72.

[12] Computed from data from the National Center for Health Statistics.

[13] A discussion of the issuesis contained in a working paper prepared by the OTA staff, *Issues Involved in the Study of the, Potential Changes 1)1 the Characteristics and Use of the Automobile Transportation System* OTA, Oct. 21, 1977.

Table 87. Safety Issues

Goals. —By what process should the Federal Government set safety goals for the automobile transportation system, and in what forms should these goals be expressed—quantitative, qualitative?

Involvement.—To what extent and how does the achievement of safety goals require Federal Government involvement with the automobile transportation industry, State, and local governments? Private institutions and the general public/individuals? What should be the roles of each of these groups?

Methodologies. —To what extent should the Federal Government use benefit-cost, cost effectiveness, or other methodologies to assess automobile safety strategies and improvements?

Requirements. —Should the Federal Government set minimum safety requirements for each class of vehicle, highway, and user? If so, how should those requirements and associated risk management activities be set pertaining to safety at entry, in operation, and at reentry?

Priorities and Allocation.—How should the Federal Government set priorities for achieving safety goals among strategies dealing with vehicles, highways, and system users?

Technology .—What should the Federal Government do to decrease the time to attain general usage of proven safety advances?

Involvement. —Should the Federal Government impose upon the automobile transportation system safety measures beyond those which individuals, governments, and industry perceive as necessary to control risk? What steps should the Federal Government take to improve the understanding of individuals, governments, and industry of the nature of risk and benefits of managing risks?

Costs.— How should the Federal Government determine how the cost of safety is allocated? Who should pay? How much? When? By what means?

- the responsibility of the Federal Government in matters affecting the public health,
- the resources available,
- questions of individual freedom and choice,
- public and private sector interests, and
- public attitudes and opinions.

There is general agreement that the traffic safety problem is severe and worthy of serious attention, but there is debate over what to do about the problem, No single stakeholder group in the automobile transportation system is wholly responsible for traffic crashes, and no single stakeholder could effectively or completely solve the safety problem. Likewise, there is no unanimous "public opinion" on the technical and political feasibility of solutions.

Although there is no one solution and no single party responsible for action, there are many technical features of the automobile transportation system and many behavioral aspects of highway users which, if altered, could make partial contributions to a reduction in highway losses. The marketplace has not provided sufficient incentive to bring about these changes. Thus, Federal initiative and Federal involvement appear to be appropriate.

For many years highway crashes were generally considered "accidents" caused by individuals, and hence an individual problem. Although this view is still held by some, there is growing awareness that traffic crashes, and the resulting death and injury, are a community problem not borne solely by the individuals involved. This view leads to a broad, and more objective framework for assessing traffic safety problems, developing countermeasures, and establishing priorities among them.

There is little debate over the cause of crashes. The majority of traffic crashes are caused by the vehicle drivers, although roadway and vehicle features may contribute to the cause of about one-third of all crashes. (See table 88.) The issue of establishing priorities centers on whether safety strategies should focus on crash prevention or crash severity reduction. Crash prevention strategies apply countermeasures to eliminate the cause of crashes, thus their occurrence. Crash severity reduction strategies seek to prevent or minimize injury when a crash occurs.

Table 88.—Traffic Crash Causation

Element	Estimated percentage of crash causation
Vehicle	4-12
Highway	10-30
Driver	70-90
Violation	20-30
Decision	20-30
Attention	40-60

SOURCE U S Department of Transportation, National Highway Traffic Safety Administration, *Tri-Level Study of the Causes of Traffic Accidents Final Report*, Vol. I: Causal Factor Tabulations and Assessments, prepared by the Institute of Research in Public Safety, Mar. 31, 1977; National Safety Council, *Accident Facts*

It is difficult to find effective countermeasures for the driver-related crash causation categories shown in table 88. The effectiveness of traffic laws in preventing improper driver behavior appears to be limited, and the magnitude and extent of law enforcement is subject to public approval. Various forms of driver education and training might reduce the rate of decision errors, but the degree of improvement attainable by such measures has not been demonstrated.

The largest factor of crash causation, driver inattention, **also** does not lend itself to practical countermeasures. Driving, especially in the United States, is a relatively simple, repetitive task requiring a low level of conscious decision-making. Highways and vehicles have been designed to make the driving task easier and more comfortable. It is likely that human error will continue to be a major cause of traffic crashes, unless ways are found to augment the performance of the driver with automatic control systems.

The vehicle factors that are the primary causes of crashes are defects in brakes, wheels, and tires. The leading highway features that cause or contribute to crashes are obstructed view and slick roads.

The mechanisms that cause injury and death, and the types of bodily damage incurred in crashes, are well known. The chief mechanism is abrupt decelerative dissipation of kinetic energy in crashes. Vehicle occupants sustain injury when striking the interior of the vehicle during a crash, Passengers ejected from vehicles in collisions suffer injury from impact with the vehicle and the ground, highway, or other structures. Pedestrians and cyclists are injured by striking, or being struck by, the vehicle and by the subsequent impact with the roadway or ground. The method to reduce injury is to spread the impact forces over a greater surface area and a longer time, thus reducing the severity of the contact.[14] Crash severity reduction strategies can be effective, and reasonably amenable to evaluation. Highway design features, if properly maintained, would remain throughout the life of the highway. Safety design criteria for motor vehicles, once established, would also be long-lasting.

[14]W. Haddon, Jr., and Susan P. Baker, *Injury Control, Insurance Institute for Highway Safety*, March 1978.

Photo Credit U.S. Department of Transportation

In summary, for long-range determination of safety priorities, an analytical framework that embraces all loss-reduction strategies is appropriate. Each safety strategy must be evaluated for its potential effects, impacts, and feasibility of implementation. Thus, a comprehensive analysis of strategies is required to determine priorities among them.

Policy Framework

Figure 44 shows a policy framework based on a functional subdivision of the automobile transportation system. This framework helps identify policies and related issues applicable to safety countermeasures. The framework specifies a programmatic approach to each component of the system. Issues are related to programs in hierarchical levels. An abbreviated listing of policy areas is shown under the boxes representing system elements in figure **44.** A policy analysis flow diagram is depicted in figure **45.**

Highway Design

Highway design and condition can contribute to both the frequency and severity of traffic crashes. The *National Highway Safety Needs Report*[15] (hereafter referred to as the "Needs" report), identified 37 safety countermeasures, including 19 related to highway design features. Tables 89, 90, and 91 list these countermeasures, and rank them by cost-effectiveness, cost to implement, and potential to forestall death and injury. Table 92 shows the 19 highway design-related countermeasures.

The "Needs" report estimated that these 19 highway improvements could save about **34,000** lives and a million injury-producing accidents over a 10-year period. The actual benefits of these countermeasures could be even greater because most would be maintained well over 10 years and would continue to accrue the benefits of reduced death and injury.

[15]U.S. Department of Transportation, Office of the Secretary, *National Highway Safety Needs Report*, April 1976.

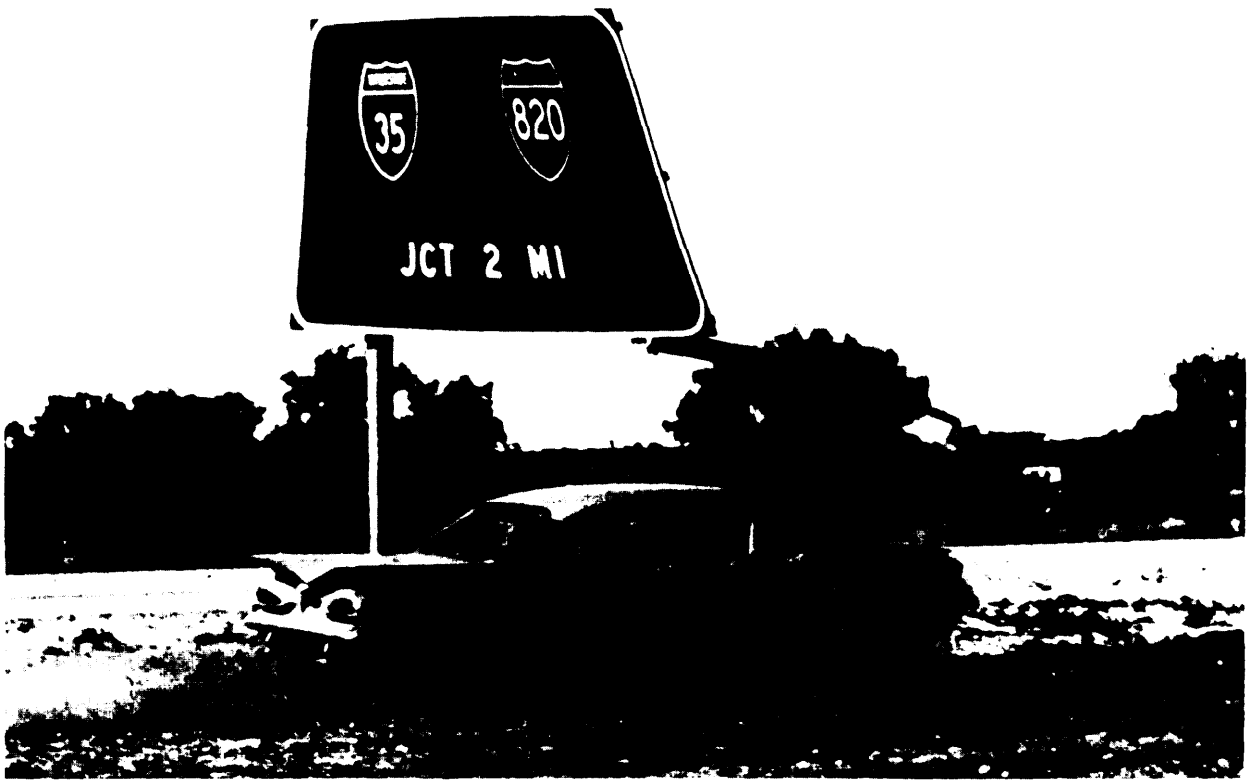


Photo Credii U S Department of 7ransportation

Figure 44.—issues, Policies, and Strategies for Traffic Safety

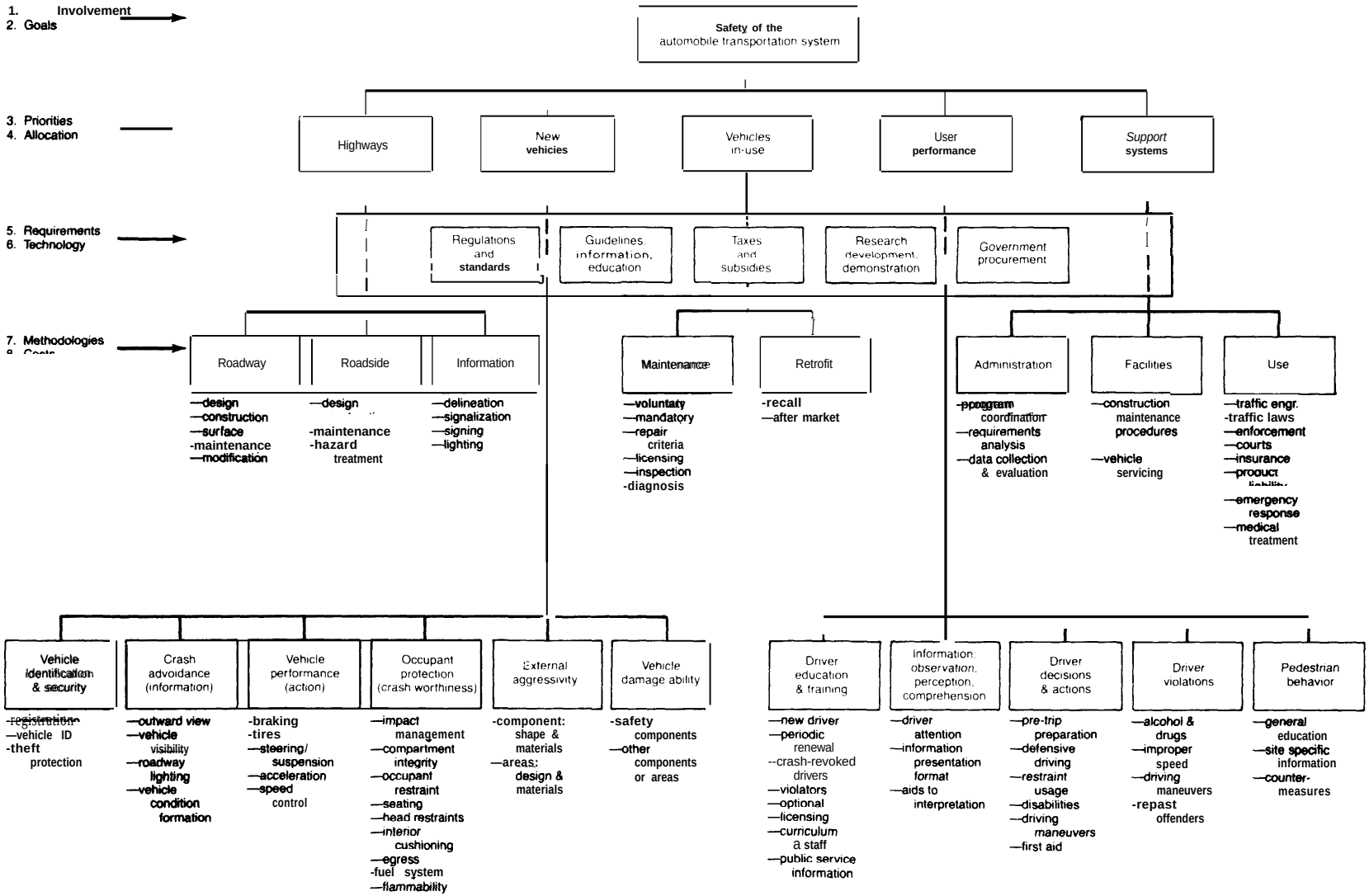


Figure 48.—Policy Analysis Flow Diagram

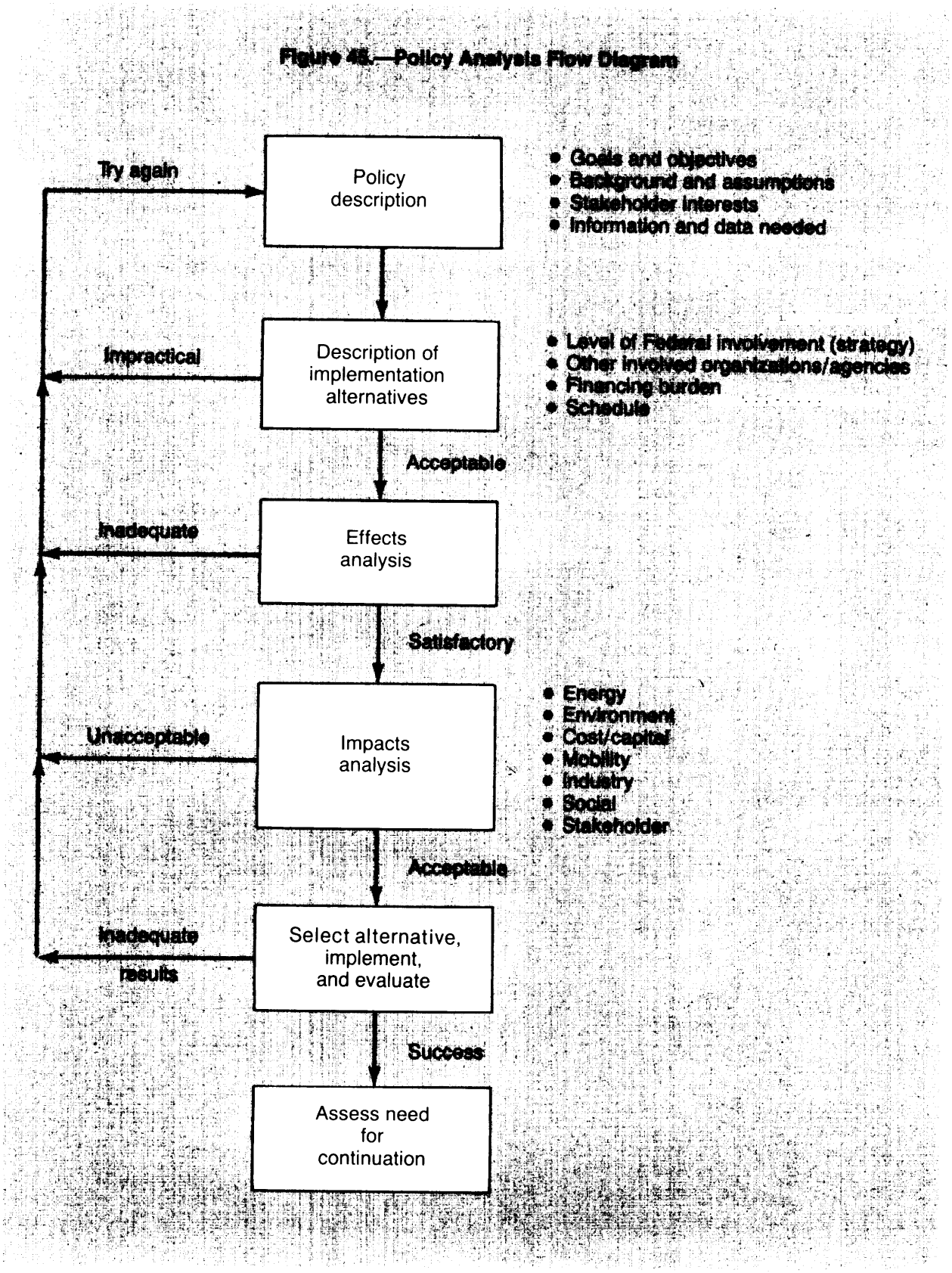


Table 89.—Ranking of Countermeasures by Decreasing Cost-Effectiveness in Present Value Dollars Per Total Fatalities Forestalled— 10-Year Total

Countermeasure	Fatalities forestalled (A)	cost ($ millions) (B)	Dollars per fatality forestalled (c)
1. Mandatory safety belt usage	**89,000**	$ 45.0	**$ 506**
2. Highway construction and maintenance practices	**459**	9.2	**20,000**
3. Upgrade bicycle and pedestrian safety curriculum offerings	**649**	13.2	**20,400**
4. Nationwide 55 mph speed limit	**31,900**	676.0	**21,200**
5. Driver improvement schools	**2,470**	53.0	**21,400**
6. Regulatory and warning signs	**3,670**	125.0	**34,000**
7. Guardrail	**3,160**	108.0	**34,100**
8 Pedestrian safety information and education	**490**	18.0	**36,800**
9 Skid resistance	**3,740**	158.0	**42,200**
10 Bridge rails and parapets	**1,520**	69.8	**46,000**
11 Wrong-way entry avoidance techniques	**779**	38.5	**49,400**
12 Driver improvement schools for young offenders	**692**	36.3	**52,500**
13 Motorcycle rider safety helmets	**1,150**	61.2	**53,300**
14. Motorcycle lights-on practice	**65**	5.2	**80,600**
15. Impact-absorbing roadside safety devices	**6,780**	735.0	**108,000**
16. Breakaway sign and lighting supports	**3,250**	379.0	**116,000**
17. Selective traffic enforcement	**7,560**	1,010.0	**133,000**
18. Combined alcohol safety action countermeasures	**13,000**	2,130.0	**164,000**
19. Citizen assistance of crash victims	**3,750**	784.0	**209,000**
20. Median barriers	**529**	121.0	**228,000**
21. Pedestrian and bicycle visibility enhancement	**1,440**	332.0	**230,000**
22. Tire and braking system safety critical inspection—selective	**4,591**	1,150.0	**251,000**
23. Warning letters to problem drivers	**192**	50.5	**263,000**
24. Clear roadside recovery area	**533**	151.0	**284,000**
25. Upgrade education and training for beginning drivers	**3,050**	1,170.0	**385,000**
26. Intersection sight distance	**468**	196.0	**420,000**
27. Combined emergency medical countermeasures	**8,000**	4,300.0	**538,000**
28. Upgrade traffic signals and systems	**3,400**	2,080.0	**610,000**
29. Roadway lighting	**759**	710.0	**936,000**
30. Traffic channelization	**645**	1,080.0	**1,680,000**
31. Periodic motor vehicle inspection—current practice	**1,840**	3,890.0	**2,120,000**
32. Pavement markings and delineators	**237**	639.0	**2,700,000**
33. Selective access control for safety	**1,300**	3,780.0	**2,910,000**
34. Bridge widening	**1,330**	4,600.0	**3,460,000**
35. Railroad-highway grade-crossing protection (automatic gates(excluded)	**276**	974.0	**3,530,000**
36. Paved or stabilized shoulders	**928**	5,380.0	**5,800,000**
37. Roadway alinement and gradient	**590**	4,530.0	**7,680,000**

SOURCE US Department of Transportation Office of the Secretary, National *Highway Safety Needs Report, April 1976*

Table 90.—Ranking of Countermeasures by Increasing Costs of Implementation in Present Value Dollars—10-Year Total

Countermeasure	cost ($ million)
1. Motorcycle lights-on practice	$ 5.2
2. Highway construction and maintenance practices,	9.2
3. Upgrade bicycle and pedestrian safety curriculum offerings.	13.2
4. Pedestrian safety information and education	18.0
5. Driver improvement schools for young offenders	36.0
6. Wrong-way entry avoidance techniques.	38.5
7. Mandatory safety belt usage	45.0
8. Warning letters to problem drivers	50.5
9. Driver improvement schools	53.0
10. Motorcycle rider safety helmets	61.2
11. Bridge rails and parapets	69.8
12. Guardrail	108.0
13, Median barriers	121.0
14. Regulatory and warning signs	125.0
15. Clear roadside recovery area	151.0
16. Skid resistance	158.0
17. Intersection sight distance	196.0
18. Pedestrian and bicycle visibility enhancement	332.0
19. Breakaway sign and lighting supports	379.0
20. Pavement markings and delineators.	639.0
21. Nationwide 55 mph speed limit	676.0
22, Roadway lighting.	710.0
23. Impact-absorbing roadside safety devices.	735.0
24. Citizen assistance of crash victims.	784.0
25, Railroad-highway grade-crossing protection (automatic gates excluded)	974.0
26. Selective traffic enforcement	1,010.0
27, Traffic channelization.	1,080.0
28. Tire and braking system safety critical inspection—selective.	1,150.0
29. Upgrade education and training for beginning drivers.	1,170.0
30. Upgrade traffic signals and systems.	2,080.0
31. Combined alcohol safety action countermeasures.	2,130.0
32. Selective access control for safety	**3,780.0**
33. Periodic motor vehicle inspection—current practice.	**3,890.0**
34. Combined emergency medical countermeasures	**4,300.0**
35. Roadway alinement and gradient	**4,530.0**
36. Bridge widening	**4,600.0**
37. Paved or stabilized shoulders	**5,380.0**
Total	$41,600.0

SOURCE: U.S. Department of Transportation, Office of the Secretary, *National Highway Safety Needs Report*, April 1976.

Table 91 .—Ranking of Countermeasures by Decreasing Potential To Forestall Fatalities and Injury Accidents— 10-Year Total

Countermeasure	Fatalities forestal led (A)	Injury accidents forestalled (B)
1. Mandatory safety belt usage . . .	89,000	3,220,000
2. Nationwide 55 mph speed limit .	31,900	415,000
3. Combined alcohol safety action countermeasures	13,000	153,000
4. Combined emergency medical countermeasures	8,000	146,000
5. Selective traffic enforcement . .	7,560	296,000
6. Impact-absorbing roadside safety devices	6,780	158,000
7. Tire and braking system safety critical inspection—selective . .	4,590	80,000
8 Citizen assistance of crash victims	3,750	
9 Skid resistance	3,740	95,000
10 Regulatory and warning signs . .	3,670	43,000
11 Upgrade traffic signals and systems	3,400	33,000
12 Breakaway sign and lighting supports.	3,250	27,000
13 Guardrail.	3,160	52,800
14 Upgrade education and training for beginning drivers.	3,050	31,000
15 Driver improvement schools . . .	2,470	13,000
16 Periodic motor vehicle inspection—current practice	1,840	71,900
17 Bridge rails and parapets	1,520	15,300
18 Pedestrian and bicycle visibility enhancement.	1,440	24,200
19 Bridge widening.	1,330	51,000
20 Selective access control for safety	1,300	50,300
21. Motorcycle rider safety helmets	1,150	14,400
22. Paved or stabilized shoulders . .	928	35,800
23. Wrong-way entry avoidance techniques , ...	779	3,290
24. Roadway lighting.	759	29,600
25. Driver improvement schools for young offenders	692	27,000
26. Upgrade bicycle and pedestrian safety curriculum offerings	649	11,200
27. Traffic channelization	645	31,500
28. Roadway alinement and gradient	590	23,000
29. Clear roadside recovery area . . .	533	20,700
30. Median barriers	529	2,740
31. Pedestrian safety information and education	490	19,200
32. Intersection sight distance	468	18,300
33. Highway construction and maintenance practices.	459	18,000
34. Railroad-highway grade-cross-*protection* (automatic gates excluded)	276	1,080
35. Pavement markings and delineators.	237	9,210
36. Warning letters to problem drivers.	192	3,760
37. Motorcycle lights-on practice . .	65	1,680

SOURCE: U.S. Department of Transportation, Office of the Secretary, *National Highway Safety Needs Report*, April 1976.

Table 92.—Countermeasures Related to Highway Design—10 Year Total (dollars in millions of 1977 constant dollars)

	Estimated deaths forestalled, cumulative	Estimated injuries forestalled, cumulative	Estimated societal costs forestalled, cumulative	Estimated cost of countermeasure cumulative
1. Regulatory and warning signs	3,670	371,800	$ 2,633	$ 250
2. Guardrail	6,830	509,100	4,204	466
3. Skid resistance	10,570	1,016,100	7,375	782
4. Bridge rails and parapets	12,090	1,055,900	8,031	922
5. Wrong-way entry avoidance techniques	12,869	1,064,500	8,322	999
6. Impact-absorbing roadside safety devices	19,649	1,457,300	12,135	2,469
7. Breakaway sign and lighting supports	22,899	1,805,500	14,470	3,227
8. Median barriers	23,428	1,876,700	14,917	3,469
9. Clear roadside recovery area	23,961	1,930,500	15,299	3,771
10. Intersection sight distance	24,429	1,978,100	15,636	4,163
11. Upgrade traffic signals and systems	27,829	2,323,900	18,081	8,323
12. Roadway lighting	28,588	2,400,900	18,626	9,743
13. Traffic channelization	29,233	2,482,800	19,152	11,903
14. Pavement marking and delineators	29,470	2,506,700	19,322	13,181
15. Selective access control for safety	30,770	2,637,500	20,251	20,741
16. Railroad-highway grade-crossing protection	31,046	2,640,300	20,353	22,689
17. Bridge widening	32,376	2,772,900	21,299	31,889
18. Shoulders	33,304	2,866,000	21,961	42,649
19. Roadway alinement and gradient	33,894	2,925,800	22,384	51,709

SOURCE OTA, using U S Department of Transportation, Off Ice of the Secretary, *National Highway Safety Needs Report,* April 1976.

There would be a sizable savings associated with forestalled death and injury. For the 10-year period, using the cost data in table **82,** the social costs forestalled would be $ll.2 billion for **34,000** deaths. Assuming **2.6** injuries per injury-producing crash that is forestalled and an average injury cost of $3,809, the total injury costs forestalled would be $11.1 billion. The total societal costs forestalled would be **$22.3** billion in 1977 constant dollars and 1977 costs. (See table 92.)

The total cost of implementing these 19 highway design features is estimated in the

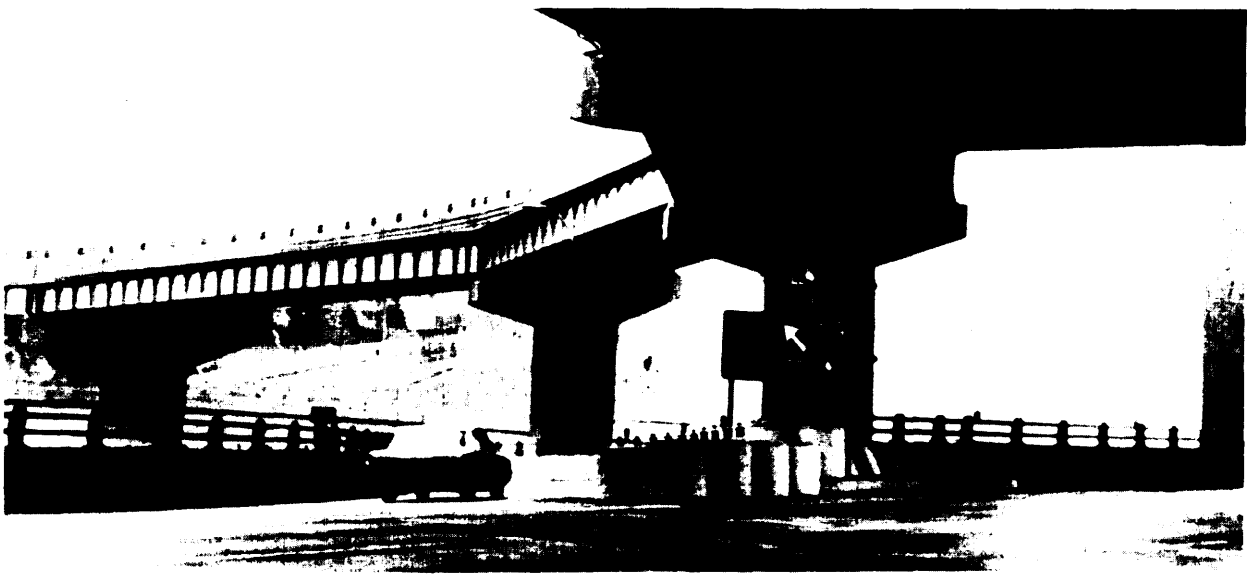


Photo Credit Department of *Transportation*

"Needs" report to be $26 billion over 10 years in present value dollars (from 1974 estimates). This cost estimate converted to 1977 constant dollars is $49 billion over 10 years. If this cost were spent evenly over a 10-year period, there would be approximately 15-percent additional burden on the highway-financing structure (about 4 mills, or four-tenths of a cent, for every 100 vehicle miles traveled). The principal beneficiaries of this transfer of funds would be the State and local highway departments and the highway design and construction industry, which would receive increased employment and revenues.

Cost-benefit comparison is hampered by inadequacy of data and by uncertainty about their interpretation. For example, the cost of an injury forestalled may not equal the average cost of an injury, but instead might be the net cost of replacing a severe injury with a minor injury plus the cost of a minor injury forestalled, However, the available data can be organized to show how the cost-benefit analysis might apply to program development. Table **92** contains the 19 highway design features ranked in order of decreasing cost-effectiveness. The cumulative expenditures are tabulated, along with the cumulative societal costs forestalled. A hypothetical, economic-oriented, cost-benefit ratio of 1:1 occurs at about item 15 on the Iist of 19 items.

The energy impacts of these highway improvements would be primarily in the use of additional construction energy. Mobility would be enhanced by safer highways, but highway capacity, speed, etc., would not change much as a result of these features. Environmental impacts would result from the use of wider rights-of-way, and the clearance of trees, rock outcropping, etc. Landowners of adjacent properties also would be impacted in some cases. Roadside right-of-way regulations now permit the installation of utility poles, which would have to be moved. Alternatively, the utility lines could be put underground.

Vehicle Design Features

The current Federal Motor Vehicle Safety Standards and proposed additions or amendments were presented earlier, in tables **84** and **85.** There is some evidence that these safety standards are saving lives and reducing injuries and that benefits exceed costs. [16] The passive restraint standard, effective for all cars by the **1984** model year, has also been shown to be cost-effective. [17] When the fleet is fully equipped with passive restraints in the **1990's,** DOT estimates that about **9,ooo** lives will be saved annually in addition to the estimated **3,oOO** lives saved annually through the use of seat belts. (See table **93.) Further** evaluation of other Federal Motor Vehicle Safety Standards is in progress, and some modifications are expected by the early **1980's,** in accordance with a 5-year plan recently released by DOT. (See table **85.)**

The long-range objective in vehicle safety is to have on the market an affordable automobile that offers high levels of safety, damage resistance in low-speed collisions, and protective features to mitigate pedestrian and cyclist injury. The Research Safety Vehicle (RSV) program of DOT is demonstrating that such a goal is achievable within the state of current technology ,18 Figure **46** shows two versions of vehicles designed under this program.

Table 94 shows requirements for three levels of crashworthiness. Research Safety Vehicles, such as those illustrated in figure **46,** are exceeding Level II and approaching Level III crashworthiness specifications. The results of the RSV program to date indicate that a four- or five-passenger vehicle, approaching Level 111 requirements and meeting fuel-economy and emission standards, can be manufactured for about $800 more than a similar vehicle meeting today's safety standards. " Further work in the program is aimed at reducing that cost to, perhaps, as low as $4oo.

Accurately determining the necessary level of vehicle crashworthiness, occupant protection, and crash avoidance features for the vehicle

---

[16] *Effectiveness, Benefits, and Costs of Federal Safety Standards for Protection of Passenger Car Occupants.*

[17] Allstate Insurance Company, *Automotive Occupant Protective Safety Air Cushion Expenditure/Benefit Study,* prepared by the John Z. DeLorean Corporation, August 1975.

[18] Ronald L. Braun, "Toward Safer Motor Vehicles," *IEEE Spectrum,* November 1977, pp. 80-86.

[19] U.S. Department of Transportation, National Highway Traffic Safety Administration, *Research Safety Vehicle Program* (Phase II), Final Report, Volumes I-III, prepared by Calspan Corporation, Report Nos. 802250, 8022.51, 802252, February 1977.

Table 93

Part A.—Occupant Crash Protection System Effectiveness Estimates'

A IS injury level	Lap belt	Lap and shoulder belt	Air cushion	Air cushion and lap belt	Passive belt and knee bolster	Knee bolster
1	0.15	0.30	0	0.15	0.20	0.06
2	.22	.57	.22	.33	.40	.10
3	.30	.59	.30	.45	.45	.15
4-6	.40	.60	.40	.66	.50	.15

[a]Effectiveness shown as fraction of persons not injured in specified injury category who otherwise would be without the use of a restraint system

Part B.— Effectiveness of Occupant Crash Protection Systems[b]

	Fatalities prevented per year	Injuries prevented per year (A IS 2-5)
Lap and shoulder (15 percent) and lap (5 percent) belts (nominal projection)	3,000	39,000
Lap and shoulder (35 percent) and lap (5 percent) belts (optimistic projection)	6,300	86,000
Lap and shoulder belt (70 percent usage)	11,500	162,000
Lap and shoulder belt (100 percent usage)	16,300	231,000
Lap belt (100 percent usage)	10,900	96,000
Driver-on I y air cushion:[c]		
Nominal projection	**9,600**	86,000
Optimistic projection	11,500	107,000
Full-front air cushion:		
Nominal projectional	12,100	104,000
Optimistic projection	13,500	115,000
Passive belts:		
Nominal projection	9,800	117,000
Optimistic projecting	10,700	129,000

[b]These estimates assume the car population and occupant fatality rates to be that of 1975 (approximately 100,000,000 cars and 27,200 people, respectively), 10,000,000 cars to be manufactured annually, and the distribution of injuries by severity to be the same as in 1975.
[c]Belt use for this mixed active and passive system is assumed to be the same as for the active belts for the passenger and the same as the air cushion system for the driver. These estimates assume 72.56 percent of front seat occupants are drivers.
[d]Assumes 20 percent lap belt usage by all front seat occupants.
[e]Assumes 40 percent lap belt usage by all front seat occupants.
[f]Assumes 60 percent passive belt usage, i.e., 40 percent of people defeat the system.
[g]Assumes 70 percent passive belt usage, i.e., 30 percent of people defeat the system.
SOURCE: Brock Adams, Secretary of Transportation, U.S. Department of Transportation, *Motor Vehicle Occupant Crash Protection*, House Document No. 95-177, June 30, 1977

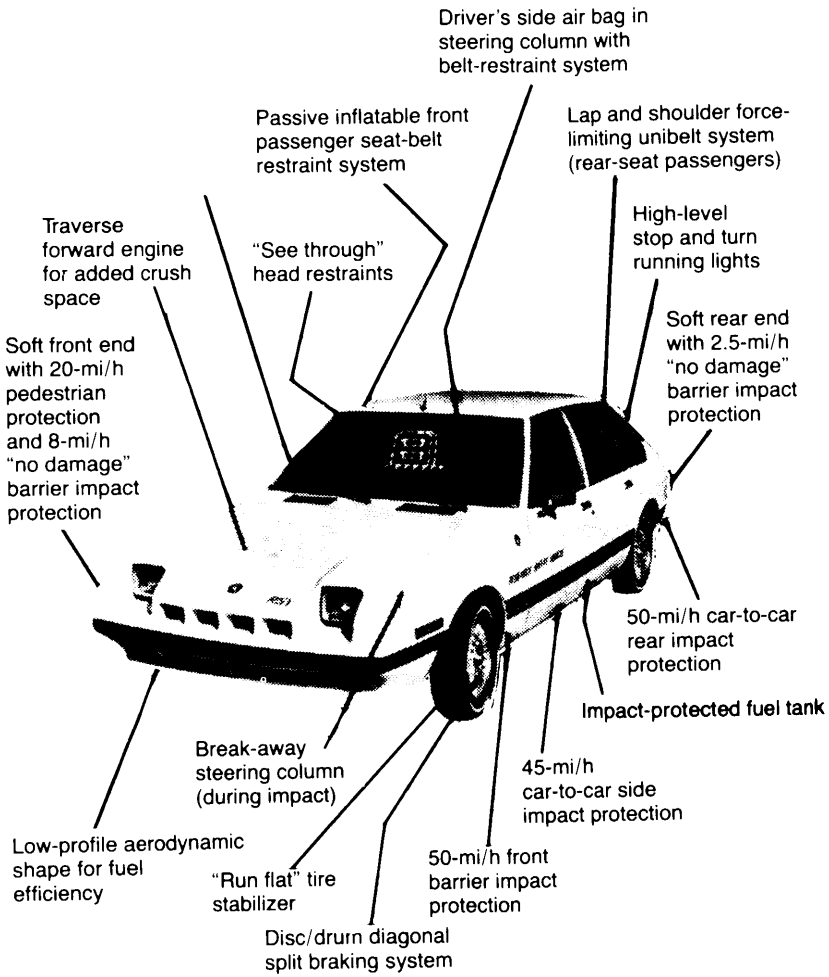
fleet is still a research question. The attainment of Level II requirements by the mid-1980's is a reasonable expectation from a technical standpoint and has been suggested in the recent report by the Federal Task Force on Motor Vehicle Goals Beyond 1980.[20] Whether to pursue crashworthiness beyond Level II is a question that requires more study. Developing a fleet of "socially responsible" vehicles could be accomplished under the current legislative authority of the National Traffic and Motor Vehicle Safety Act of 1977 through Federal Motor Vehicle Safety Standards.

Achieving high levels of vehicle occupant protection could reduce the deaths and injuries of vehicle occupants beyond the projections of the lifesaving potential of passive restraints. It has been estimated that the addition of Level II crashworthiness would increase the effectiveness of the Air Cushion Restraint System by **30** to **40** percent. (See table 95.) The ability to'mitigate pedestrian and pedacycle death and injury through front-end design modifications still requires technical examination.

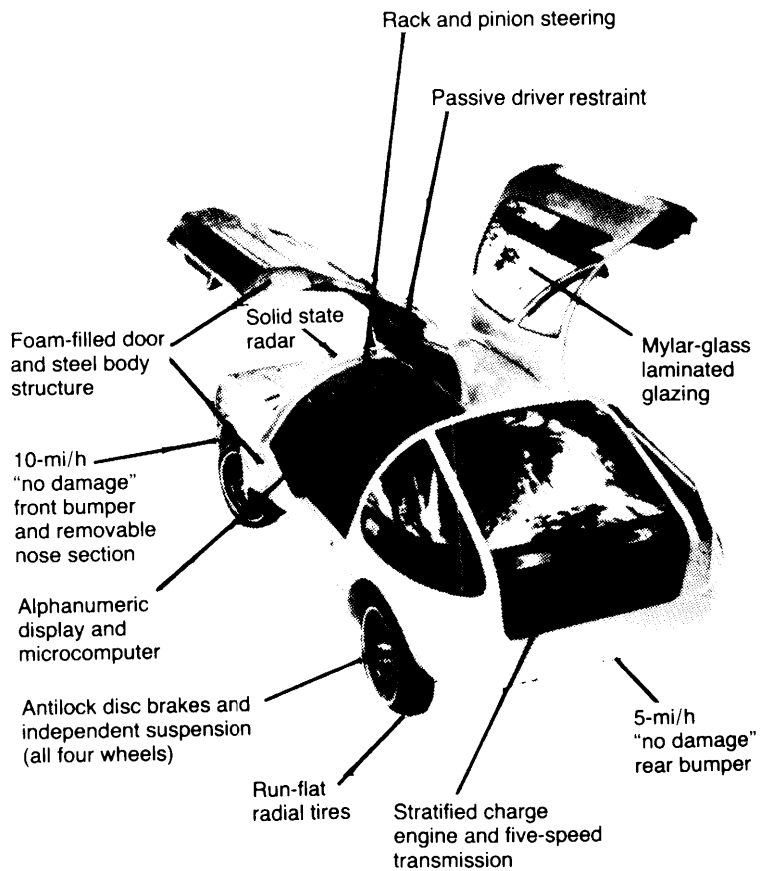
The impacts of the evolution of much safer cars would be reflected primarily in the price of new cars to the consumer. Over the last decade, vehicle safety improvements have added an estimated **$250** to the retail price of a 1978

[20]U.S. Department of Tranpsortation, *The Report by the Federal Task Force on Motor Vehicle Goals Beyond 1980,* Volumes I-II, September 1976.

Figure 46.— Two Research Safety Vehicles



The Calspan/Chrysler Research Safety Vehicle developed for the National Highway Traffic Safety Administration (NHTSA) started with a Simca 1308 that was modified to provide front barrier and rear car-to-car protection at speeds up to 80.5 km/h (50 mi/h).



The Eagle II RSV, developed by Minicars, Inc., Goleta, Calif., was designed "from the ground up" to accommodate safety, energy, environmental, and economic factors, as well as full-scale mass-production technologies.

SOURCE: Ronald L. Braun, "Toward Safer Motor Vehicles," *IEEE Spectrum*, November 1977.

Table 94.—Vehicle Crashworthiness and Damageability Levels[a]

	Crashworthiness	Crash avoidance	Damageability
Level 1.	All FMVSSs[b] pertaining to crashworthiness which are effective for MY 1975 cars **and** those which will become effective during the 1976-80 period (protection for front, rear side, rollover, fire), 30 mph frontal performance.	All FM VSSS[c] pertaining to crash avoidance which are effective for MY 1975 cars **and** those which will become effective during the 1976-80 period (braking performance, lighting, field of view, and other).	Both Levels I & II correspond to existing standards (Part 581 requiring that front and rear bumper sustain 5 mph impacts without damage to vehicle except for m i nor dents on bumpers).
Level II	Same as Level I plus 40 mph passive frontal protection, **20** mph passive side protect ion and egress.	**Same as** Level I plus all weather brake performance (anti lock brakes).	
Level Ill.	Same as Level I plus passive protection for— Impacts: • 50 mph flat barrier frontal (O-45) angle • 50 mph narrow barrier • 100 mph car to car al ined • 100 mph car to car offset • 45 mph car to car side • 30 mph rollover • 50 mph car to car rear • Egress, all test conditions • No fuel leakage, all test conditions	Same as Level II plus run f l at tires.	Same as Level I for impact speeds up to 10 mph.

[a]Level I and Level II specifications from "Goals" study by DOT. Level III specifications were developed from the RSV program of DOT
[b]Federal Motor Vehicle Safety Standards

Table 95.—Effectiveness of Level II Crashworthiness With Air Cushion Restraint Systems

	Fatality reduction (percent)[a]	Injury reduction (percent)
Air cushion	43	20
Air cushion and lap belt.	50	24
Level II and air cushion	59	23
Level ll, air cushion, and lap belt	65	27

[a]Percent reduction in number of unrestrained fatalities and injuries for front, side, and rear crash modes (rollovers not included)
SOURCE: U.S. Department of Transportation, *Interagency Task Force on Motor Vehicle Goals Beyond 1980,* 1976

automobile[21] with no observable negative effect on vehicle sales. The average new car buyer now spends $750 to $1,000 on comfort and convenience options.[22] This indicates that additional vehicle safety, costing perhaps $4oo to $800, may be within acceptable limits.

Vehicles in Use

The primary policy consideration for vehicles in use is mandatory periodic motor vehicle inspections. Vehicle-in-use safety inspection programs were in effect in many States even before enactment of the Highway Safety Act of 1966. It

"U.S. Department of Transportation, National Highway Traffic Safety Administration, *The Contributions of Automobile Regulation,* Preliminary Report, June 1978.
[21]1 bid

has been shown that bad tires and bad brakes contribute to crashes (up to 5 percent of total crashes) .23 The actual number of cars on the road operating with inadequately maintained brakes and worn tires may be much higher,[24] The impetus for uniform inspection programs may come from efforts to meet emissions goals since including a safety inspection in such a procedure is logical.

The effect of current inspection programs in reducing crashes, injury, and death has not been clearly demonstrated. Any upgrading or broadening of such programs would not have the support of reliable effectiveness data. The primary impact is cost to the consumer for repair and and replacement of parts, particularly in addition to repairs to meet fuel-economy and emissions requirements.

User Performance

In the *Highway Safety Needs Report*, the three strategies with the highest lifesaving potential are related to driver behavior. They are increased seatbelt usage, the 55 mph speed limit, and alcohol countermeasures.

Seat belts have been required in all passenger cars since 1964. However, the current usage rate is only about **20** percent (15 percent lap and torso, 5 percent lap only). Even at this low degree of use, it is estimated that about **3,000** lives are saved annually by the use of belts. It is also estimated that an increase to a 70-percent lap and shoulder belt usage rate would save an additional **8,500** lives per year and prevent 162,000 injuries of severity 2 to 5 on the AIS code. (See table 93.)

With passive restraints entering the fleet in the 1980's, seat belts and seat belt laws may not be as important in the long run. However, passive restraints will not be widespread in the vehicle fleet until the 1990's. Also, 25 percent of the vehicle fleet is composed of light trucks, a percentage that is expected to rise. Currently there is no requirement for passive restraints in vehicles other than passenger cars, although such a regulation for light trucks is under consideration by DOT.

Two types of passive restraint systems are being considered to meet the Federal standard: the air cushion restraint system (ACRS, or air bag) and the passive seat belt. The ACRS used with a lap belt is considered to offer the best overall protection, although the passive belt system is also quite effective. The passive seat belt is a "coercive" system, in that the user must agree to leave the belt in place. The passive belts can be easily disconnected.

There are several approaches that may raise the level of seat belt usage: educational or promotional campaigns, economic incentives, and mandated belt *use.*

Promotional campaigns, the approach now used by the Federal Government, do not appear to have much potential. Incentives such as insurance credits, or other economic rewards, have not been tried in this country. Mandatory belt-use laws are in effect in 16 foreign countries, 2 Canadian provinces, and Puerto Rico. The success of these laws varies, primarily depending on social acceptance and the level of enforcement. (See table 96.)

One of the best examples of mandatory belt use laws is that of the State of Victoria, Australia. In 1970, surveys showed safety belt use rates in Australia to be comparable to those in the United States—about 20 percent. After the law became effective in January 1971, the usage rate rose to about 50 percent immediately, despite an amnesty on prosecution against offenders. When enforcement and prosecution were implemented, the use rate rose to an average of 75 percent in the metropolitan area of Victoria .25 By early 1972, following the reported success in reducing injuries and deaths in Victoria, all of the other Australian states had enacted similar laws. The reported results are mixed but favorable. Table **96** shows a 25-percent reduction in deaths and a 20-percent reduction in injuries in Australia from 1972 to 1974.

[23]U. S. Department of Transportation, National Highway Traffic Safety Administration, *Tri-Level Study of the Causes of Traffic Accidents Final Report,* Volume I: Causal Factor Tabulations and Assessments, prepared by Institute for Research in Public Safety, Indiana University, Report No. DOT-HS-034-3-535-77-TAC, Mar. 31,1977,

[24]Joseph I. Innes, Viability of the Motor Vehicle Diagnostic Inspection Concept Demonstrated by NHTSA, *Fifth International Congress on Automotive Safety – Proceedings* (Washington, DC U S. Department of Transportation")

[25]R. Ungers, "The Introduction of Compulsory Seat Belt Wearing Laws in Australia and Their Effect, " *Proceedings of the Scientific Conference on Traffic Safety* (Ottawa, Canada: 1974).

Table 96.—Effect of Safety Belt Usage Laws Around the World—2/1/77

Country	Effective date of law:	Penalty for noncompliance	Enforcement[a]	Public information program	Belt usage before law effective	Belt usage after law effective	Occupant fatality reduction	Occupant injury reduction
Czechoslovakia	1-1-69	Max $10						
Japan	12-1-71	None	0	None		Aug 1975 8%		
Australia (all states)	1-1-72	Max $20	1	Yes	1971—25%	1972-75 68-85%	1972-74 25%	1972-74 20%
New Zealand	6-1-72	Max $200	1		May 1972 30%	1972-1975 62-83%		
France	7-1-73[b]	$10-$20	1	Yes	March 1973 26%	March 1974: 64% 1975—85% (Outside cities) In city: daytime 15% nightime 30% July 1976 25%	1975—22%	1975—32%
Puerto Rico	1-1-74	$10	0-1	Yes	July 1973 30/0	March 1976 79%		
Sweden	1-1-75	Max $100 Usual $10	1	Yes	360/0	July 1975 92%	June-Sept 1975—39%	June-Sept 1975—24%
Spain	10-3-74[c]	$15						
Belgium	6-1-75	$1.50-$15.00						
Luxembourg	6-1-75	$5-$12.50						
Netherlands	6-1-75	$0.20-$120			Oct 1974 Rural: 28% Urban: 15%	June 1975 Rural: 72% Urban: 58%		
Finland	7-1-75	None	3	Yes	June 1975 9-40%	Dec 1975 53-71%		
Norway	9-1-75	None	0	Yes	Sept '73-'75 Rural: 37% Urban: 15%	June 1975 Rural: 61% Urban: 32%		
Israel	7-1-75	Max $110	3	Yes	June 1975 8%	Aug 1975 80% July 1976 80%		
Switerland	1-1-76	$8	1-2	Yes	May 1975 35-500/0	May 1976 87-95%		
West Germany	1-1-76	None	1	Yes		Jan 1976 70-77%		
Canada—Ontario	1-1-76	**$20-100**	1	Yes	Oct 1975 17%	Mar 1976 77% June 1976 64%	Jan-July 1976—17%	Jan-July 1976—15%
USSR	1-1-76	**$1.50**	1	None				
Canada—Quebec	8-15-76	**$10-$20**	0-1	None	190/o			

[a] 0-Essentially none
1-When motorist stopped for another purpose
2-Strict (when observed not wearing belt)
3-Only requested to "buckle up" by officer
[b] On roads outside city limits. As of 1-1-75 usage was also required on city roads between 10 p.m. and 6 a.m.
[c] Usage not required in cities.
[d] Urban roads exempt.
NOTE: Blanks indicate no information available.
Data Prepared by: Office of Driver and Pedestrian Research NHTSA.
SOURCE: U.S. Department of Transportation, National Highway Traffic Safety Administration, *Traffic Safety '76*.

Other examples of foreign experience with seat belt laws are not as encouraging. In Puerto Rico, the usage rate rose from 3 percent to only 25 percent between 1973 and 1976. In Japan, the laws are not enforced and the usage rate is reported to be 8 percent. On the other hand, Norway, with no enforcement, has usage rates of 61 percent in rural areas and 32 percent in urban areas. In Sweden, the mandatory seat belt usage law was put into effect in 1975 and met with a high degree of public acceptance, resulting in high usage rates. Approximately 80 percent of front seat occupants in Sweden were observed to wear seat belts.

Foreign experience indicates that mandatory seat belt use laws can be an effective safety measure. However, foreign experiences tells little about their probable success in this country.

Photo Credit U.S. Department of Transportation

It is clear that the use of seat belts saves lives and reduces injury, and mandatory seat belt laws with reasonable levels of enforcement would probably increase the usage rate somewhat. However, no State in the United States has enacted legislation requiring seat belt use. Public opinion seems to be against such a law, which is regarded as an undue infringement of individual freedom.

Speed

The national 55 mph speed limit went into effect in early 1974. There were **9,000** fewer traffic deaths in 1974 compared with 1973, a 17-percent reduction. The average speed on rural interstate highways before **1974** was above **65** mph. In 1974 and 1975, the average rural interstate speed dropped to below **58** mph,

41-079 O - 76 - 15

Many studies have examined the relationship between the drop in fatalities and the speed limit, and various conclusions have been reached. The evidence seems to indicate that reduced highway speeds contributed to the reduction in traffic deaths, but the magnitude of this contribution is subject to debate. Many researchers believe that about **50** percent of the reduction in deaths in 1974 was due to the 55 mph speed limit. [26] DOT data show that the most significant drop in fatality rates occurred on highway systems most affected by the reduced speed limit—the Interstate System and rural primary roads. However, other factors could be involved, as evidenced by the fact that urban pedestrian deaths also dropped about 17 percent from 1973 to 1974. It is unlikely that urban pedestrian fatalities were affected by the speed limit change.

DOT data indicate that in **1976** and 1977 the average speed on the highways, and the percentage of drivers operating their vehicles above the posted speed limit, increased steadily over the 1974 and 1975 figures. [27] The speed limit is actually a State law, and enforcement of the law is a matter for the States. There is lack of support for strict enforcement in many State legislatures, and enforcement places an increased imposition on enforcement agencies. DOT claims the public has indicated support for the speed limit. [28] However, the public's most convincing expression on the matter is how fast they drive. One apparent factor in noncompliance is that the original intent of the law—to save gasoline—is not perceived as necessary.

In October 1977, the Secretary of Transportation recommended that the President seek from Congress dedicated funding assistance for State speed limit enforcement, and the authority to establish compliance standards .29 In the recently signed Highway Safety Act of **1978,** Congress authorized **$50** million for the States for each fiscal year from 1979 through 1982 along with a compliance schedule, penalties, and incentives for enforcement of the speed limit.

The debate on speed limits and safety is not over. The equilibrium of the reduced speed limit has not been reached, and most conclusions on the subject can be considered only tentative. Educational and promotional campaigns to convince people to drive slower for safety and fuel economy have suffered, and will probably continue to suffer, from credibility problems. Increased enforcement levels may produce a public backlash.

The safety aspects of the 55 mph speed limit need to be addressed from a broader base of experience. Speed is relevant to safety primarily in the context of a crash. The data regarding speeds at which crashes occur are inadequate. The DOT Crash Recorder Program, designed to collect this data, was initiated many years ago and has consistently failed to gain congressional support. Speeding in the context of "reckless driving" can also contribute to the cause of a crash. Trying to enforce speed limits in general does not readily address this problem.

There is also the question of why motor vehicles need to have the capacity for high speed. Data on traffic behavior under constrained top-speed conditions is limited, although many vehicles on the road essentially have a limited top speed of **60** to **70** mph. Vehicle engine sizes are becoming smaller as the country moves into the "economy" era. Still, top-speed limitation would be considered by many to be an infringement on personal (and technological) freedoms, and would inhibit manufacturers from using "power" and "speed" as a common part of sales campaigns. These arguments, however, overlook the consideration that drivers of the next generation may feel differently about automobiles and driving.

Interestingly, top speed for electric vehicles is a primary constraint and is traded-off with vehicle range. If electric vehicles became widely used, top-speed limitation would be an inherent feature of the automobile transportation system.

---

[26] U.S. Department of Transportation, Federal Highway Administration, *Safety Aspects of the National 55 MPH Speed Limit,* November 1976.

[27] U.S. Department of Transportation, *Report to the President on Compliance With the 55 MPH Speed Limit,* Oct. 14, 1977, and personal communication with the Office of Statistics and Analysis, U.S. DOT.

[28] Ibid.

[29] Ibid.

Alcohol Use

Alcohol consumption per capita has risen 50 percent in the United States since 1960. This high rate of increase is not expected to continue, but alcohol will probably continue to be the customary social intoxicant, [30] Alcohol use is a far-reaching social phenomenon. The data suggest that alcohol is a factor present in as much as **50** percent of crashes involving occupant fatality and in one-third of the fatal pedestrian crashes. [31] Data are not available to determine that alcohol is, in fact, the cause of such crashes. However, the debilitating effects of excessive consumption of alcohol on perception, on the motor-sensory system and, in some cases, on personality, are well known from experimental studies. It can be inferred that the risk of a crash increases as the driver's performance capability degrades. What is not known is how to alter this cultural habit or separate the task of driving from alcohol use.

There have been several notable attempts to curb or control the use of alcohol with driving. The Alcohol Safety Action Program in the United States and the Scandinavian drunk-driving laws are examples.

The National Highway Traffic Safety Administration sponsored 35 local Alcohol Safety Action Programs (ASAP) at a cost of about **$70** million over a 2-year period. In the ASAP communities, enforcement activities regarding drunk-driving laws were intensified, and efforts to identify and rehabilitate problem drinkers were increased. NHTSA initially claimed a small reduction in fatalities as a result of the ASAP program. Other researchers have disputed this claim, stating that year-to-year fluctuations in fatalities in ASAP areas could account for changes that occurred during the program. [32] NHTSA, when discussing ASAP in annual reports, makes no claim to any safety improvements as a result of the program, The success of ASAP is said to be the improvement in the local traffic safety system, and the fund of experience gained. [33]

Scandinavian countries have had fairly strict drunk-driving laws for over **30** years. Their approach is characterized by the routine penalty of imprisonment for attaining a specified level of blood alcohol, determined by scientific tests. Studies in Sweden indicate that the incidence of intoxication in fatally injured drivers is about **30** percent, or somewhat less than the **50** percent found in this country. However, a recent analysis of the Scandinavian data raises questions regarding the credibility of this information and casts doubt on the effectiveness of strict drunk-driving laws as a deterrent to drunk driving. "

Other countermeasure programs have been tried in the United States, Canada, Austria, Great Britain, and Czechoslovakia. While few of these programs have been thoroughly and systematically analyzed, there is doubt about their success and the practicality of the countermeasures employed.

Several findings in the literature are noteworthy. Alcohol abuse is not solely a problem on the highways although symptoms and consequences of the problem can be found there. The use of alcohol by society is widespread and accepted. Moderate use of alcohol may even have beneficial effects on some users. Yet the United States appears to lack any consensus on what constitutes responsible use of alcohol .[35] This statement could be extended to include drugs used for medicinal and other purposes, Without consensus on what constitutes excessive use, there is a limited justification for enactment of alcohol-related highway safety countermeasures.

---

[30] U. S. Department of Transportation, National Highway Traffic Safety Administration, *National Highway Safety Forecast, A 1990 Traffic Safety Outlook,* September 1 976.

[31] "U.S. Department of Health, Education, and Welfare, Public Health Service, National Institute on Alcohol Abuse and Alcoholism, *Second Special Report to the Congress on Alcohol arid Health* June 1 974.

[32] Paul L. Zador, 'Statistical Evaluation of the Effectiveness of Alcohol Safety Action Projects," *Accident Analysis and Prevention* Vol. 8, No. *1,* February 1976.

[33] U.S. Department of Transportation, National Highway Traffic Safety Administration, Federal Highway Administration, *Highway Safety* 2977, DOT HS-803 372, June 1978.

[34] Laurence H. Ross, "The Scandinavian Myth: The Effectiveness of Drinking-and-Driving Legislation in Sweden and Norway, ' The *Journal of Legal Studies,* Vol. 4, No. 2, June 1975.

[35] U.S. Department of Health, Education, and Welfare, *Alcohol and* Health

Support Systems

Support systems include data collection, construction and maintenance, procedures, traffic laws, enforcement, insurance, product liability, and emergency medical service, Many of these items have significant potential for safety improvement policy in the short and long term. Some of these improvements are listed as prospective countermeasures in tables **89** to 91.

Improved construction and maintenance practices are shown to be very cost-effective. Improved emergency medical countermeasures could potentially save many lives. In 1975, it was reported that 47 percent of traffic fatalities died either en route to the hospital **(6** percent), in the emergency room (35 percent) or in the hospital **(6** percent) .3' Emergency medical service is an important element in highway safety, both in appropriate trauma treatment and rapid evacuation to an appropriate facility.

Goals

Specific goals for vehicle emissions and fuel economy have shown themselves to be useful and effective. It is important to consider the utility of specific and quantitative goals as a way to promote future traffic safety. Section 401 of the Highway Safety Act of 1966 states that "the Secretary is authorized and directed to assist and cooperate . . . to increase highway safety. " Section **402** of the same law states that: "Each State shall have a highway safety program . . . designed to reduce traffic accidents and deaths, injuries, and property damage resulting therefrom. " The preface to the National Traffic and Motor Vehicle Safety Act of 1966 states: "That Congress hereby declares that the purpose of this act is to reduce traffic accidents and deaths and injuries to persons resulting from traffic accidents. " The question arises, however, whether these goals, as written, provide sufficient stimuli for achievement and whether some of these stated objectives would have been met if it had not been for the 17-percent reduction in fatalities that occurred in 1974 for other reasons.

In 1968, just 2 years after enactment of the major safety legislation, the Department of Health, Education, and Welfare issued a report of the Secretary's Advisory Committee on Highway Safety.[37] In discussing the relatively uncharted areas of the highway safety field, the report stated:

> There do not exist even the most rudimentary standards of performance by which to measure achievement. This suggests that traffic safety might well be one of the first areas of national effort to be made the subject of a carefully elaborated and comprehensive set of national goals. At that point it will become possible to make dependable calculations as to what allocation of resources will be required to achieve goals that have been set . . . ***it is in the context*** of ***such*** *national goals the research and program priorities* ***should be established. "3***[8]

The data collection and analysis process necessary to formulate specific goals and assess progress toward reaching them is within the current state-of-the-art. Data now collected by the States, and the present (FARS) and future (NASS) data collection programs of the DOT may be adequate for such a purpose. But the adequacy is not universally accepted, and the outcome of the continuing debate will, by necessity, lead to improving the data. The data are most limited in the areas of selecting and evaluating safety countermeasures that might be used to meet specified goals, Also, there is considerably less data on traffic injuries than on traffic deaths.

The difficulty with safety goals is in the process of setting them, and the framework, the plan, and the lines of responsibility for achieving them. Safety goals could be expressed either as some target for reduction of total deaths, injuries, and property damage resulting from accidents or as a scheduled reduction in the rates of deaths, injuries, and property damage based on exposure to risk (e. g., miles of travel or years of vehicle occupant exposure).

---

[36] U.S. Department of Transportation, National Highway Traffic Safety Administration, *1975 Societal Costs of Motor Vehicle Accidents*, DOT HS-802 119, December 1976.

[37] U.S. Department of Health, Education and Welfare, *Report of the Secretary's Advisory Committee on Traffic Safety*, February 1968,

[38] Ibid., pp. 72 and 73.

Such goals could be set either for the Nation as a whole or for each State. Alternatively, States could set their own goals in consultation with the Federal Government. The national goal would thus become the sum of State goals. Safety goals could be established either systemwide or for each element of the automobile transportation system (i. e., vehicles, highways, and highway users) and for specified subclasses within each element. For example, there might be separate goals for large and small passenger cars, or there might be separate goals for each class of roads.

Safety goals could provide a focus for long-range, comprehensive safety planning which, until now, has been inadequate or nonexistent. [39] The nature of the problem is such that the achievement of goals will require participation by all parties to improve all elements of the transportation system. Goals could provide a direct stimulus for coordinated action. This, in turn, could help to resolve the stifling negotiations on implementation of technological improvement. Further, setting goals and formulating plans to achieve them would focus attention on the levels of expenditures needed and on the payoffs from these investments—both in monetary terms and in the quality of life.

[39] "A review of the literature has uncovered no comprehensive safety plan at the Federal or State level. The only suggesiton of one is in the recent DOT study, *National Transportation Trends and Choices*, January 1977.