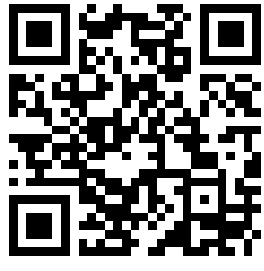

Safety for Motor Vehicles in Use

A report to the Congress
from the Secretary of Transportation

June 1968

U.S. Department of Transportation

SAFETY FOR MOTOR VEHICLES IN USE

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Secretary of Transportation

U.S. Department of Transportation
JUNE 1968

THE SECRETARY OF TRANSPORTATION
WASHINGTON, D.C. 20590

June 24, 1968

Honorable Hubert H. Humphrey
President of the Senate
Washington, D. C. 20510

Dear Mr. President:

Pursuant to the requirements of Section 108(b)(1) of Title I of the National Traffic and Motor Vehicle Safety Act of 1966 (P. L. 89-563). I am pleased to transmit the report of the Department of Transportation on the "Safety for Motor Vehicles in Use."

Sincerely,

Alan S. Boyd

Enclosure

THE SECRETARY OF TRANSPORTATION
WASHINGTON, D.C. 20590

June 24, 1968

Honorable John W. McCormack
Speaker of the House of
Representatives
Washington, D. C. 20515

Dear Mr. Speaker:

Pursuant to the requirements of Section 108(b)(1) of Title I of the National Traffic and Motor Vehicle Safety Act of 1966 (P. L. 89-563), I am pleased to transmit the report of the Department of Transportation on the "Safety for Motor Vehicles in Use."

Sincerely,

Alan S. Boyd

Enclosure

FOREWORD

Americans traveled nearly 1.8 trillion passenger miles last year—an average of about 9,000 miles per person. About 95 percent of that travel is by motor vehicle.1/ Motor vehicles and highways are, in a sense, our mass transportation system.

Nor will our reliance on that system soon diminish. Not only will automobiles in use increase by about 25 percent during the next 10 years, but travel in them will increase by about 40 percent. During the same period, the population will increase at only one half of the rate of automobiles in use and only one third the rate of intercity automobile passenger miles.2/

In addition, about 27 percent of the intercity freight3/ is hauled by motor vehicle, both privately owned and common carrier.4/ In all, there are over 78 million automobiles, 15-1/2 million trucks, and almost 2 million motorcycles on the road.5/

Compared with other transportation systems the motor vehicle is by far the most convenient—but it is also the most destructive:

- more than 10,000 injured on an average day
- more than 1,000 killed in an average week
- about $1 billion cost for crashes each month.

1/ Includes private passenger vehicles and buses. See Appendix A.

2/ For population projections, see U.S. Department of Commerce, Bureau of the Census, Current Population Reports, p. 25, No. 388 (March 14, 1968), "Summary of Demographic Projections." Projections of motor vehicles in use and of travel by Department of Transportation, Office of Economics, based on data from the Bureau of Public Roads, Department of Transportation.

3/ 1966. Excludes freight transported by oil and gas pipelines.

4/ Interstate Commerce Commission, Transportation Economics, November-December, 1967.

5/ U.S. Department of Transportation, Bureau of Public Roads, Highway Statistics, 1966, p. 31.

These conditions continue unabated. Simply to state them makes tragically clear the need for massive corrective measures. Equally clear, however, is the fact that no single magical solution is at hand.

For there is no single motor vehicle safety problem. Rather, there is a variety of interrelated problems. This range of problems demands an array of solutions, as well as a balanced strategy for implementation of these solutions.

The foundation for such an approach was laid in the landmark safety legislation recommended by President Johnson and passed by the Congress in 1966:

> The National Traffic and Motor Vehicle Safety act of 1966 (P. L. 89-563) directs the Secretary of Transportation to issue safety standards for new and used motor vehicles and for motor vehicle equipment.
>
> The Highway Safety Act of 1966 (P.L. 89-564) directs the Secretary to issue standards for State highway safety programs and to provide grants-in-aid to assist in implementation of the standards.
>
> Both Acts authorize the Secretary to conduct highway and motor vehicle safety research, testing, development, and training.

This report, as required under Section 108 of the National Traffic and Motor Vehicle Safety Act, describes the initial results of a study of the safety of vehicles in use. It identifies problems and recommends immediate and long-range countermeasures to deal with them. These programs, which are calculated to mesh with existing efforts at the national and State levels, include standards for the safety performance of vehicles in use and for motor vehicle inspection. These standards will complement the standards applicable to new motor vehicles.

The standards to be promulgated will define the requisite safety performance of the motor vehicle from the time it leaves the showroom floor until it is finally scrapped. They will not exempt the new vehicle because there is no such thing as a "new vehicle" in use, and significant mechanical and electrical failures are common-place even in the "break-in" period.

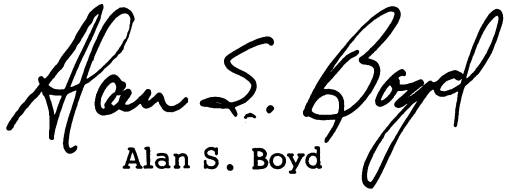
Deterioration of a vehicle with time is inescapable, whether from normal wear or abuse, defective construction, improper maintenance, poor quality of original or repair parts, inadequate skill of mechanics, or other factors. With the deterioration of such components as brakes, steering system, and tires, the chances of the vehicle becoming involved in a crash increase. The

purpose of a safety program for vehicles in use is to counteract and limit this inevitable deterioration.

The most difficult decision is to determine the point at which repairs should be made mandatory—to arrive at a proper balance between cost and risk. The safety programs for vehicles in use will affect the owners of some 100 million vehicles, and even seemingly minor program decisions might cost billions of dollars annually. Although the public is presumably willing to pay for safety—both directly, in the form of inspection fees and repairs to defective parts, and indirectly, in the form of Government expenditures—it must also be given assurance that it is getting value for its money in the form of increased safety. Consideration will also have to be given to the fact that a disproportionate amount of cost might have to be borne by people in low-income groups who can least afford the expensive repairs their older vehicles require.

The magnitude of the problem is unmistakable. Action as well as broad research is urgent. All countermeasure alternatives must be explored, including the provision of adequate—and perhaps in urban areas—free public transportation to lessen the need for private vehicles and encourage the junking of very old, dangerous vehicles.

However, programs aimed at correcting the most obvious used vehicle safety deficiencies plainly cannot be deferred until all the vexing questions are finally answered. We must proceed with the first steps, which are described in this report.



Alan S. Boyd

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SUMMARY

About half of the 94 million motor vehicles in use today are estimated to be deficient in critical aspects of safety performance.1/ This condition is of concern to everyone—drivers, passengers, and pedestrians are all potential victims of poorly maintained vehicles. Furthermore, relatively few owners are able to judge the adequacy of corrective repairs.

The major conclusion of this report is that vehicle deterioration is an important factor in the etiology of accidents and that the Government and the general public share an immediate interest in and responsibility for upgrading the safety qualities of all vehicles permitted on public thoroughfares. The National Traffic and Motor Vehicle Safety Act of 1966 (P.L. 89-563) and the Highway Safety Act of 1966 (P.L. 89-564) provide a number of avenues under which this can be accomplished. These include:

- The issuance of safety performance standards for used motor vehicles to complement the standards for new motor vehicles and motor vehicle equipment.2/
- The issuance of standards for the manufacture of new motor vehicles and equipment which would insure safety reliability performance over a designated period of use.
- Grants-in-aid to assist States in establishing or expanding motor vehicle inspection programs to meet uniform national

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1/ Number excludes motorcycles. Typical defect rejection rates for States with periodic motor vehicle inspection are on the order of 40 percent. See Illustration 2.5. It is expected that the overall national percentage of vehicles with safety performance deficiencies would be somewhat higher.

2/ The first Federal Motor Vehicle Safety Standards were issued on 31 January 1967. See Appendix B for a list of standards which have been issued and pending proposals for standards. All these prescribe performance criteria to be met at the time of initial manufacture.

standards.1/ These can serve as the means for ensuring compliance with the standards for used motor vehicles.

- The funding of broad-gauged research to improve understanding of the essential aspects of used motor vehicle safety, including automotive repair technology, performance of new and rebuilt replacement parts, used vehicle marketing practices, and other consumer protection requirements.

Current Programs

Used Motor Vehicle Safety Standards

Ideally, all vehicles should perform as safely as those that are new. Unfortunately, there is no way to prevent deterioration of mechanical, electrical, and other vehicle parts with use and age. Consequently, two basic steps must be taken:

- First, those aspects of motor vehicle performance that are likely to deteriorate to the point of being a safety hazard must be identified. Likely candidates include braking, steering, and suspension.

- Second, it is necessary to establish the maximum permissible deterioration in safety performance permitted before corrective repairs or removal of the vehicle from the road are required.

The law requires that motor vehicle standards be reasonable, practicable, and appropriate. For used motor vehicles this can be achieved by considering:

- The degree of hazard associated with each type of deficiency.

- The frequency with which this deficiency is likely to occur.

- The costs of determining its presence and of correcting it.

1/ The Department of Transportation standard for motor vehicle inspection was issued on 26 June 1967. See Appendix C.

The standards being proposed for issuance will be applicable, as appropriate, to all classes of motor vehicles, including passenger cars, multi-purpose passenger vehicles, trucks, trailers, buses, and motorcycles. In the case of commercial vehicles the extension of present Bureau of Motor Carrier Safety (formerly part of the Interstate Commerce Commission) safety regulations from interstate to intrastate private and common carriers is being considered as is an additional standard for weight/horsepower limitations.

Although only limited quantitative data are now available, the most critical aspects of safety performance will be covered by standards now being proposed for issuance. The major areas involved include braking (service, emergency, parking), steering, handling, and tires.

To broaden the scope of future standards, there is an immediate need to mount a systematic program for obtaining relevant technical and economic data.1/ For example, there is a need to assess accurately the types and numbers of safety-related defects found in used vehicles and the safety quality levels of vehicles involved in crashes. Much more needs to be known concerning the performance of vehicle systems and components on the road—and what happens when they fail.

State Motor Vehicle Inspection

State motor vehicle inspection programs serve as the foundation of any national used motor vehicle safety effort. There already is evidence that some States with intensive periodic motor vehicle inspection programs have substantially lower vehicle accident death rates than others.2/ A number of States already are spending Federal grants-in-aid under the Highway Safety Act of 1966 to upgrade and expand both their inspection programs and the closely related programs concerned with motor vehicle registration and traffic records. Federal standards for these program areas have been issued, and more detailed guidelines are being prepared.

Over 80 percent of the vehicles in this country are located in States which presently have motor vehicle inspection statutes. As of May 1968, 31 States and the District of Columbia had periodic motor vehicle inspection statutes. Fourteen States did not have periodic motor vehicle inspection, but had only random motor vehicle inspection or permitted local motor vehicle inspection ordinances; and five States had no motor vehicle inspection requirements, or ones of limited application.

1/ The Department of Transportation Highway Safety Program Standard for motor vehicle inspection programs which is now being implemented in many States requires the collection and publication of information on defects by vehicle make and model. See Appendix C.

2/ See Chapter II, section titled, "Safety Implications of Motor Vehicle Inspection."

Expenditures by States and communities for vehicle inspection during 1967 amounted to about $22.5 million. Annual expenditures are expected to increase to $96.6 million by 1976 as States upgrade existing programs and undertake new ones to provide for the anticipated 25 million increase in the vehicle population. These estimates by the States do not cover the substantial cost of major improvements in equipment and facilities.

In addition to providing grant-in-aid assistance to the States for the needed expansion of motor vehicle inspection programs, the Department has undertaken research and related investigations of ways of upgrading the quality and effectiveness of vehicle inspection, of developing improved understanding of manpower and equipment needs, of improving technical management of inspection programs, of using automated techniques, of inspecting nonpassenger vehicles, and of evaluating the performance of the inspection program itself.

Apart from their importance to used motor vehicle safety efforts under the provisions of the two safety laws of 1966, State motor vehicle inspection programs are also required for enforcing the vehicle exhaust control provisions of the Clean Air Act (Air Quality Act of 1967, P.L. 90-148). The third area of importance is the enforcement of statutory axle load lines for trucks and buses.

A consolidated motor vehicle inspection program in each State can meet all these requirements while avoiding wasteful duplication, and at the same time helps to justify the expensive sophisticated inspection equipment needed to test for meaningful used vehicle standards. Lowered inspection costs and increased convenience to the vehicle owner, who would have to make only a single trip to an inspection station where all required inspections are made at the same time, are the other primary reasons for developing a consolidated motor vehicle inspection capability in each State.

Other State Programs

Other State highway safety programs complement motor vehicle inspection. One of the Highway Safety Program Standards issued in June 1967 by the Secretary calls for each State to have a vehicle registration system which will identify the owner of each vehicle and maintain up-to-date records detailing the make, model, year, and other characteristics of the State's vehicle population. It is estimated that the current expenditures by State and local governments of $112 million annually will rise to $186 million by 1976 for the programs which will provide the information base for much of the used motor vehicle safety effort.

Another of the standards issued by the Secretary calls for each State to establish and maintain a records system on drivers, vehicles, accidents, and roadway conditions. The foundation of all motor vehicle safety programs is objective information on the factors that lead to, or contribute to the severity of, crashes. These data are particularly important to the used motor

vehicle safety effort in assessing the contribution of vehicle deterioration. It is estimated that the current State and local expenditures in this high priority program area of $61.3 million annually will increase to $130 million by 1976.

In order to mount a comprehensive used motor vehicle safety effort, it is hoped that States will undertake programs in several other areas in addition to those currently in progress in periodic motor vehicle inspection, vehicle registration, and traffic records. Such programs could focus particularly on the training and qualifications of mechanics and the quality of repairs. The Department of Transportation will investigate the need for Federal standards for State programs in these areas and the amounts of Federal grants that would be required to assist States with their implementation.

Research

Under the provisions of both the National Traffic and Motor Vehicle Safety Act and the Highway Safety Act, the Department of Transportation has launched the initial phases of a comprehensive motor vehicle and highway safety research program. The projects dealing with used motor vehicle safety cover such subjects as steering diagnostic procedures and equipment, medical engineering investigation of crashes, and automated diagnostic procedures for motor vehicle inspection.

However, a substantial expansion of this program is required in the following five categories:

A. Research on Vehicle Deterioration With Use.

B. The Significance to Safety of Vehicle Deterioration.

C. Inspection and Diagnosis of Vehicle Safety Quality Conditions.

D. Maintenance and Repair of Vehicles.

E. Implementing Used Vehicle Safety Programs.

CONCLUSIONS AND FUTURE ACTIONS

The principal finding of this report is that comprehensive action programs to improve used vehicle safety should be initiated now, centering on mandatory periodic motor vehicle inspection in the States where the compliance with minimum Federal safety performance standards will be determined. However, the exact levels of performance ultimately to be required, the details of inspection techniques and procedures, and the steps to be taken to meet the social and economic costs of these programs must await the accumulation of much more information than is presently available on these difficult issues.

This report accordingly recommends programs of immediate action to improve the safety of vehicles in use now, coupled with parallel programs to obtain more information that will lead to program improvements in the future. The major conclusions of the report and the Department of Transportation's plans for meeting these two fundamental needs are listed below. The schedule for implementing these plans will depend on the availability of resources.

Federal, State, and Local Program Interaction

Conclusion. A coordinated Federal, State, and local program is required to improve the safety qualities of motor vehicles now in use, of which more than half have at least one important safety deficiency. The Department of Transportation can provide the leadership for the needed national effort as follows:

a. Under the National Traffic and Motor Vehicle Safety Act of 1966 - by issuing used motor vehicle safety performance standards, and conducting benefit/cost investigations, fact-finding, and other research in the closely correlated areas of automotive repair technology, training of mechanics, and quality of new and rebuilt replacement parts.

b. Under the Highway Safety Act of 1966 - by preparing guidelines and detailed technical information to assist States in the implementation of the already issued periodic motor vehicle inspection standard under which States will enforce used motor vehicle safety standards to be issued under the Traffic Act, and by studying areas for additional State highway safety program standards such as automotive repair practices of dealers and garages, training and qualification of mechanics, and consumer protection on repairs.

Plan. The Department of Transportation with the assistance of the States and other interested persons will prepare for issuance used motor vehicle standards on such critical safety performance properties as braking, steering, handling, and tires, and proceed with detailed engineering analysis on additional standards for later issuance.

The scope of the existing State highway safety program standard for periodic motor vehicle inspection will be expanded to ensure effective implementation of the standards for used vehicles.

The Department of Transportation will continue and expand the benefit/cost investigation, fact-finding, and other research already begun in the related used motor vehicle safety program areas of repair technology and improvement of skill levels and training of mechanics.

The Department of Transportation will undertake, in cooperation with the States and with the advice and guidance of the National Highway Safety Advisory Committee and the National Motor Vehicle Safety Advisory Council, and with the assistance of the Vehicle Equipment Safety Commission and other interested groups, a comprehensive investigation of State and community needs for implementing expanded used motor vehicle safety programs.

(See Chapters II through VII)

Interaction of Standards for New and Used Vehicles

Conclusion. The safety performance of a vehicle in use cannot be isolated from its original design and construction. It is axiomatic that used vehicle safety can and must start on the new vehicle drawing board.

a. The level of safety performance designed into the vehicle in accordance with "new vehicle" performance standards is the beginning point for defining maximum permissible safety performance deterioration in a used motor vehicle safety standard.

b. Reliability of extended performance is universally recognized as one of the critical elements in automotive design. A vehicle purchaser should be able to have some assurance that critical areas of safety performance will not fail during a specific period of use.

c. Vehicles can be designed so that repair is facilitated by easy identification and replacement of worn parts. In addition, the vehicle can be designed to coordinate with automated diagnostic equipment to facilitate analysis of the inoperative or worn parts or systems to determine the repairs required.

Plan. The Department of Transportation will investigate the feasibility of broadening the scope of new vehicle standards to cover safety performance after periods of extended use, together with procedures to facilitate the diagnosis and correction of worn systems and parts.

(See Chapter III)

Consolidation of Motor Vehicle Inspection Programs

Conclusion. A consolidation of motor vehicle inspection programs required under separate Federal laws is strongly indicated. This includes inspection for quality of vehicle exhaust emissions under the Clean Air Act of 1967, and for braking, steering, and other safety properties under the Interstate Commerce Act and National Traffic and Motor Vehicle Safety Act of 1966 and the Highway Safety Act of 1966.

a. The individual consumer should be able to have his vehicle inspected for all health and safety performance properties in a single trip to an inspection station; he should not have to make separate trips for exhaust emission checks and for safety checks. He should also expect defective or potentially defective performance to be identified for him.

b. States should not have to maintain different motor vehicle inspection management and records for purposes of different Federal laws requiring motor vehicle inspection.

c. Irrespective of the need to examine the quality of exhaust emissions for an assessment of their contribution to air pollution under the Clean Air Act, for safety

purposes the vehicle exhaust system must be inspected for possible leakage of dangerous fumes into the passenger compartment. Both of these types of inspections can readily be made at the same time. In addition, dynamic braking tests can be performed since exhaust emissions must be measured under various conditions of engine acceleration and deceleration.

d. With improved inspection procedures and sophisticated equipment consolidating all engine performance including exhaust emission and safety performance analysis, the inspection service could supply diagnostic information regarding needed engine adjustments in order to help the consumer avoid vehicle breakdowns that can cause or influence the occurrence of crashes, as well as unnecessary costly repairs. While the cost to the consumer for motor vehicle inspection might increase with more thorough inspection of more items, the advantages provided by automation would offset some if not all of this cost.

e. The responsibility for developing requirements for implementing motor vehicle inspection at the State level in response to various Federal requirements is under the jurisdiction of the Department of Transportation, subject to performance values for exhaust emissions established under the Clean Air Act.

Plan. To obtain the greatest return on the entire investment in motor vehicle inspection, by all levels of government, the Department of Transportation will cooperate with the Department of Health, Education and Welfare in coordinating requirements for motor vehicle inspection at the State level, and will seek to avoid duplication and to utilize all available resources under the Clean Air Act, the National Traffic and Motor Vehicle Safety Act, and the Highway Safety Act in developing motor vehicle inspection programs at the State level that will provide effective service for the vehicle owner at minimum cost and inconvenience.

(See Chapters III and IV)

Capital Requirements

Conclusion. The capital cost associated with improved motor vehicle inspection facilities is dependent on a number of technical and administrative considerations, including the nature of the inspection tasks to be performed,

the degree of reliability and sensitivity that may be provided through automation, and the degree to which the facilities will be publicly or privately financed. Nevertheless, it is clear that a substantial capital outlay for equipment and facilities will be needed for State motor vehicle inspection programs (whether in private or State inspection stations) in checking for compliance with national standards for used motor vehicle safety.

a. The effectiveness and acceptance of used motor vehicle safety programs will substantially depend upon the efficiency, cost, and accuracy of the motor vehicle inspection procedures.

b. Modern electronic and other testing equipment for rapid, accurate, and reliable automotive inspection, although not inexpensive, is of central importance to effective inspection.

c. A survey of present motor vehicle inspection facilities indicates that few have the equipment to perform the inspection tasks that will be required as a result of future used vehicle standards. Present indications are that substantial improvements in both the capability and reliability of inspection facilities, equipment, and procedures will be required on a nationwide basis to handle a hundred million or more effective inspections annually.

d. The capital investment for semiautomated inspection equipment and facilities in all States is estimated at $600 to $800 million initially, plus some additional investments later to accommodate anticipated growth in the vehicle population.

e. Because the volume of inspections to be performed is large and will continue to grow, any capital expenditure for vehicle inspection may be distributed over the useful life of the equipment. It is likely that such expenditures will be more than counterbalanced by savings resulting from increased operating efficiency, accuracy, and reliability.

Plan. The Department of Transportation will investigate alternative techniques for meeting the heavy initial capital investment in motor vehicle inspection equipment that will be required to implement the national used motor vehicle safety program.

In connection with the investment in motor vehicle inspection equipment for the State inspection programs, the Department will consider undertaking demonstration test programs for the purpose of evaluating compliance

by manufacturers with Federal motor vehicle safety standards applicable to new motor vehicles. Similarly, the effectiveness of manufacturer's defect notification campaigns may be evaluated (i.e., whether a vehicle owner was notified, whether he responded, whether the defect was, in fact, corrected.)

(See Chapters III and IV)

Consumer Needs and Protection

Conclusion. Consumer needs and protection for both repairs and resale present important issues to be resolved in the establishment of national policy in the used motor vehicle safety effort.

a. Federal, State, and local attention to ensuring reasonable levels of safety quality in vehicles will generate higher repair and maintenance costs for the vehicle owner.

b. With rare exceptions, the individual owner is not able to diagnose the safety conditions of his car, evaluate the proficiency of repairs and quality of replacement parts, judge the reasonableness of repair costs, or otherwise exercise meaningful judgment concerning automotive repairs.

c. With rare exceptions, the individual consumer cannot evaluate the safety quality of used vehicles that he purchases from dealers or others.

Plan. The Department of Transportation will undertake a broad investigation into all aspects of the demands that used motor safety programs will place on consumers, and into means of protecting the consumer in the automotive repairs and resale marketplaces, including:

a. The establishment of skill standards and training programs for mechanics.

b. The safety regulation of parts used in repairs, and particularly rebuilt parts.

c. The development of technology and systems to lower the cost of inspection and repairs.

d. The feasibility of providing a prospective buyer of a used vehicle with a history of the vehicle's past involvement in defect notification campaigns and accidents, and of its motor vehicle inspection record.

(See Chapters IV, V and VI)

Pre-sale Inspection for Used Motor Vehicles

Conclusion. Each year, approximately 25 percent of all vehicles in use are sold as used motor vehicles.1/ Many of these vehicles are in poor operating condition. Many are sold because owners do not believe there is sufficient return for the repair investment required.

a. Used vehicles which are sold or traded each year are more likely to contain deficiencies than those vehicles typical of the population as a whole. Thus, if all vehicles sold passed a basic minimum inspection prior to resale, the level of vehicle safety quality would be significantly enhanced.

b. When all States are operationally implementing programs for the periodic inspection of all vehicles, a requirement for presale inspection of used vehicles would serve only to correct such safety deficiencies as may have come to exist between annual inspections. At that time presale inspection might well be unnecessary. At present, however, not all States have motor vehicle inspection programs, and some of those that have programs do not yet require annual inspection of every vehicle.

c. Requiring inspection of used vehicles prior to sale would produce significant safety benefits in the interim period until periodic inspection of all vehicles is accomplished throughout the nation. Presale inspection would concentrate on that portion of used vehicles which are most likely to contain deficiencies, and it would affect a large fraction of the vehicles in use. In addition, it would afford a significant measure of consumer protection for the purchaser.

Plan. The Department of Transportation will continue to study alternative techniques for beginning a presale inspection program in all States in the near future. In the event that the achievement of this goal requires amendment to existing Federal law, the Department will prepare and submit such legislation to the Congress.

(See Chapters II, IV, V and VI)

1/ Of the 78.4 million automobiles and 15.5 million trucks registered in the United States in 1966, about 21 million automobiles and about 2 million trucks were sold as used vehicles. Motor vehicle registration figures are from Table MV-1 in Highway Statistics, published by the Bureau of Public Roads, Department of Transportation; the estimates for the number of used vehicles sold were made by the Research Department, National Automobile Dealers Association (unpublished).

Critical Impact on the Poor

Conclusion. Lower-income population groups drive vehicles that are in greatest need of the more costly safety-related repairs or that cannot be economically repaired and therefore should be scrapped.

a. On the order of 50 percent of the vehicles more than 10 years old are rejected by motor vehicle inspections for serious safety deficiencies. 1/

b. Lower-income populations tend to drive older vehicles that, as a group, are in the most dangerous condition and require the most costly repairs.

c. In the absence of adequate public transportation, lower income groups often have no alternative for getting from home to work except older vehicles.

Plan. The Department of Transportation will accelerate detailed investigations of means of providing adequate—perhaps free—public transportation programs that will afford people with low income a meaningful choice between private vehicles and public transportation.

The Department of Transportation will undertake preliminary feasibility investigations on national programs of subsidized automotive repair and equipment replacement assistance for population groups who, in the absence of adequate public transportation, have no meaningful alternative to reliance on old vehicles requiring costly safety-related repairs.

(See Chapters II and VI)

Impact on Garages and Repair Shops

Conclusion. In order to service consumer needs and perform repairs properly, garages and repair shops should be able to have diagnostic equipment that is at least as accurate as that already in use in State motor vehicle inspections. Many establishments, particularly those operated by small businessmen, might not be able to provide the initial capital outlay for the equipment or other capital improvements necessary to compete in the automotive repairs market that will be generated by an expanded used motor vehicle safety program.

Plan. The Department of Transportation will investigate the needs of small business operators of garages and repair shops for Federal or other

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1/ See Illustration 2.5.

assistance in obtaining improved automotive diagnostic and repair equipment, and will, in cooperation with the Small Business Administration, consider the feasibility of a program of assistance under the provisions of the Small Business Act of 1952.

(See Chapters VI and VII)

I. LEGISLATIVE BACKGROUND

The comprehensive motor vehicle and highway safety legislation of 1966 established the basis for the national attack on motor vehicle crashes, injuries, and deaths. Inherent in the legislation is the Congress' recognition that there are two critical aspects of a vehicle's safety performance on the highway:

> First, the vehicle must be designed for safety. Subsequent care and attention cannot compensate for deficiencies in original vehicle design.
>
> Second, vehicles in use must be maintained by their owners in safe working condition. Abuse or inadequate maintenance can obviate the safety the manufacturer built into the vehicle.

The first aspect is the subject of those provisions of the National Traffic and Motor Vehicle Safety Act of 1966 which require motor vehicles and motor vehicle equipment to conform to Federal safety standards upon manufacture.

The second aspect poses exceptionally difficult questions. What a law could constitutionally require of manufacturers under Commerce Clause powers could not readily be required of all vehicle owners. Moreover, serious issues concerning the proper role of the national Government in a Federal system would be involved. For example, Congress rejected the idea that the Federal Government itself inspect vehicles in use. As Senator Philip Hart of Michigan said:

> "Used car inspection is not something the Federal Government can or should embark on directly. It is a matter best handled by strong State inspection programs."1/

Senator Warren Magnuson of Washington State, Chairman of the Senate Committee on Commerce, indicated that the Committee considered and rejected a

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1/ Congressional Record, 24 June 1966, Vol. 112, p. 13607.

specific statutory requirement for compulsory Federal safety inspection of vehicles in use,1/ because the Committee was well aware, that, unless carefully delimited, the national effort to promote used vehicle safety might infringe upon what the Senator described as "the complex field of States' rights."2/

On the other hand, the need for the Federal Government to contribute significantly to the safety of vehicles in operation was urgently apparent. In hearings on the legislation, witnesses repeatedly made clear the importance of maintaining the safety of vehicles in use. For example, Mr. H. C. Stivers, then President of the Motor and Equipment Manufacturers Association, pointed out in his testimony on the safety legislation:

> "Brakes wear out and greater pedal pressure is needed without the driver being aware of it—shock absorbers lose their effectiveness and the car wanders so gradually that the car becomes almost out of control without the driver becoming aware of it—exhaust systems can fail, and lethal, odorless, colorless gases can begin to permeate the vehicle without the driver becoming aware of anything beyond the fact that he is not feeling particularly well that day and has a touch of a headache."3/

And in testimony before the Subcommittee on Executive Reorganization of the Committee on Government Operations in the U.S. Senate, in July 1965, Mr. J. M. Roche, then President of General Motors, stated:

> "The importance of proper vehicle maintenance to overall highway safety is given special emphasis by the fact that the average car on our roads today is 6 years old and the average truck is 8 years old. Twenty states have compulsory vehicle safety inspection. In three states recognized as having among the better managed programs, the rejection rate on safety checks during the latest year in which figures were available ranged from 35.9 to 54 percent, with most of these defects being caused by lack of proper maintenance."4/

1/ Congressional Record, 24 June 1966, Vol. 112, p. 13587.
2/ Ibid., p. 13585.
3/ Hearings before the Committee on Interstate and Foreign Commerce, House of Representatives on H.R. 13228 and other bills relating to Traffic Safety, May 4, 1966, p. 946.
4/ U.S. Senate, Committee on Government Operations, Subcommittee on Executive Reorganization, Hearings on the Federal Role in Traffic Safety, July 13, 14, 15, and 21, 1965, Part II, p. 667.

In its report on the Highway Safety Act of 1966 the Committee on Public Works of the House of Representatives said:

> "We will obviate the value of every program element involved in this effort if state safety programs do not include vehicle inspection requirements. Until we discover how to achieve perpetual motion, the best engineered machine we can build is going to wear out. Like the human body, it starts to die the day it is born. Adequate maintenance can help to keep them in safe operating condition and to prolong their useful lives—and the lives of their drivers."1/

The legislation as ultimately enacted represented a recognition of the urgency and magnitude of the problem and of the need for a strong national effort to effect the institution and upgrading of nationwide vehicle inspection.

- The Highway Safety Act of 1966 directs the Secretary of Transportation to include vehicle inspection among the areas to be covered by the uniform standards to be implemented by the several States. Federal funds were authorized to help meet the cost of such a program.

- The National Traffic and Motor Vehicle Safety Act of 1966 declares that: "In order to assure a continuing and effective national traffic safety program, it is the policy of Congress to encourage and strengthen the enforcement of State inspection of used motor vehicles." It also directs the Secretary of Transportation to take the following steps:

  To "conduct a thorough study and investigation to determine the adequacy of motor vehicle safety standards and motor vehicle inspection requirements and procedures applicable to used motor vehicles in each State, and the effect of such programs authorized by this title upon such standards, requirements, and procedures for used motor vehicles...."

  To report to Congress the results of the study.

1/ U.S. House of Representatives, Committee on Public Works, Report No. 1700 on the Highway Safety Act of 1966, 15 July 1966, p. 12.

To "establish uniform Federal motor vehicle safety standards applicable to all used motor vehicles."1/

The statutory scheme thus has two basic elements:

The issuance under the National Traffic and Motor Vehicle Safety Act of 1966 of uniform Federal motor vehicle safety standards applicable to all motor vehicles in use.

The implementation of these standards through motor vehicle inspection conducted by the States pursuant to the issuance by the Secretary of an inspection standard under the Highway Safety Act of 1966.

The interrelationship of the used motor vehicle safety provisions in the two acts was explained by Representative Paul G. Rogers, a member of the House of Representatives Committee on Interstate and Foreign Commerce, during the floor debate on the safety bills:

"There are 90 million motor vehicles on American roads today. Each year, approximately 9 million new cars are sold. The basis for congressional action in the auto safety field rests with the annual loss of 50,000 lives due to highway accidents. With this basis in mind, a new Federal program of safety standards for new cars was initiated. However, due to their condition, new cars are presumably safer than old cars. If the Congress is going to act on the auto safety problem, then to make the approach through standards for new cars alone seems to touch only 10 percent of the basic matter of auto safety standards. There are 30 million used cars sold in America each year. These sales represent one-third of all the vehicles on the road. If the Congress is going to do something about safety by issuing Federal standards, such standards must deal with the question of used cars as well as new ones. The used car provisions of section 108 will enable the Secretary of Commerce (Transportation) to proceed within the existing framework of State inspection laws. Section 108, as written, will minimize Federal preemption of a question traditionally left to the

1/ Section 180(b)(1), P.L. 89-563, the National Traffic and Motor Vehicle Safety Act of 1966.

> States, yet will allow the thrust of Federal Safety efforts to be felt through 90 percent of the vehicles annually once the auto safety program is set in motion."1/

After an examination of the dimensions of the problem, this report will focus upon these two interrelated aspects of the used vehicle safety effort: the development of performance standards for used vehicles and the strengthening of State motor vehicle inspection programs.

1/ Congressional Record, 17 August 1966, p. 18781.

II. DIMENSIONS OF THE MOTOR VEHICLE DETERIORATION PROBLEM

Magnitude of the Problem

The deterioration in safety performance with usage and time of the 94 million motor vehicles on the nation's thoroughfares poses excessive and unnecessary risks to the American public. There can be no doubt that broad-gauged countermeasure programs are required--nor can there be any doubt that these programs will have a major impact on a national scale. They will involve some 72 million vehicle owners; Federal, State and local governments; motor vehicle and equipment manufacturers; new and used motor vehicle equipment distributors and dealers; fleet owners; and hundreds of thousands of inspector-mechanics.

The magnitude of the problem of achieving safety in the motor vehicle population is indicated by statistics showing the current size and rate of growth of the motor vehicle population, together with estimates of the vehicle defects existing in this population.

A comparison of the estimates of 1967 motor vehicle registrations for each State with actual registrations in 1966 is provided in Illustration 2.1. The estimated total for 1967 of more than 97 million motor vehicles represents a 3.5 percent increase over the more than 94 million registered in 1966. 1/ The growth in motor vehicle registrations, shown in Illustration 2.2, indicates a steady increase in registrations since the end of World War II. The population of the United States is expected to be 224 million by 1975 2/, compared

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1/ These figures exclude motorcycles which total about two million for 1966.

2/ U. S. Department of Commerce, Bureau of the Census, Current Population Reports, Series P-25, No. 388 (March 14, 1968), "Summary of Demographic Projections", p. 35.

ILLUSTRATION 2.1

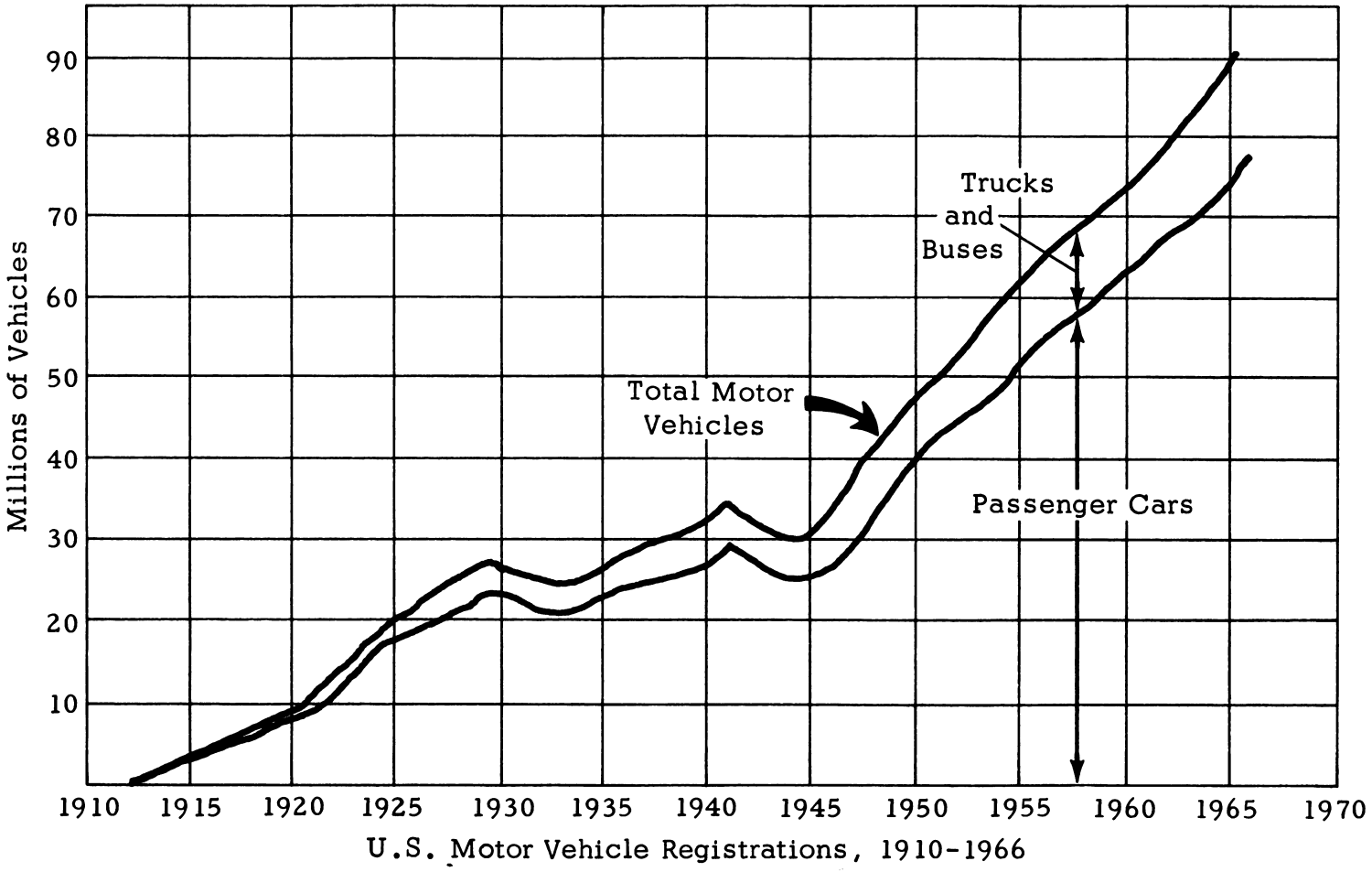
1967 MOTOR VEHICLE REGISTRATIONS*

State	Total Automobiles, Trucks, and Buses			State	Total Automobiles, Trucks, and Buses		
	Registered 1966	Estimated 1967	Percent Increase 1967/1966		Registered 1966	Estimated 1967	Percent Increase 1967/1966
Alabama	1,731,836	1,735,179	1.9	Nebraska	870,439	887,809	2.0
Alaska	108,128	110,382	2.1	Nevada	279,000	286,637	2.7
Arizona	862,950	889,615	3.1	New Hampshire	334,052	348,717	4.4
Arkansas	955,091	982,936	2.9	New Jersey	3,122,876	3,200,454	2.5
California	10,347,012	10,849,514	4.9	New Mexico	549,206	571,239	4.0
Colorado	1,200,777	1,241,870	3.4	New York	6,005,132	6,060,491	0.9
Connecticut	1,489,148	1,544,761	3.7	North Carolina	2,307,008	2,423,241	5.0
Delaware	256,481	267,660	4.4	North Dakota	406,420	404,886	-0.4
Florida	3,221,307	3,392,661	5.3	Ohio	5,238,498	5,305,391	1.3
Georgia	2,099,247	2,164,367	3.1	Oklahoma	1,495,620	1,541,907	3.1
Hawaii	324,521	336,498	3.7	Oregon	1,167,112	1,241,511	6.4
Idaho	445,823	454,572	2.0	Pennsylvania	5,196,174	5,335,237	2.7
Illinois	4,704,624	4,818,259	2.4	Rhode Island	423,433	434,362	2.6
Indiana	2,550,539	2,631,944	6.4	South Carolina	1,147,120	1,180,392	2.9
Iowa	1,609,004	1,645,023	2.2	South Dakota	401,189	406,961	1.4
Kansas	1,405,256	1,440,595	2.5	Tennessee	1,757,575	1,869,918	6.4
Kentucky	1,574,632	1,632,380	3.7	Texas	5,711,263	5,892,859	3.2
Louisiana	1,555,655	1,633,802	2.0	Utah	543,991	561,585	3.2
Maine	433,891	452,083	4.2	Vermont	186,600	194,120	4.0
Maryland	1,553,643	1,611,986	5.1	Virginia	1,874,779	1,932,478	3.1
Massachusetts	2,172,767	2,223,472	2.3	Washington	1,756,294	1,851,761	5.4
Michigan	4,024,120	4,133,428	2.7	West Virginia	730,880	765,347	4.7
Minnesota	1,942,781	1,996,925	2.8	Wisconsin	1,898,875	1,954,112	2.9
Mississippi	956,842	1,012,166	5.8	Wyoming	223,993	226,403	1.1
Missouri	2,147,531	2,211,187	3.0	District of Columbia	241,749	246,712	2.1
Montana	439,146	451,337	2.8	Total	93,962,030	96,989,132	3.2

*These figures were prepared by the Bureau of Public Roads on the basis of State reports of vehicle registrations in the early months of 1967 and information available on current trends, vehicle production, and other factors. They include both privately and publicly owned vehicles, except those owned by the military services.

ILLUSTRATION 2.2

GROWTH OF MOTOR VEHICLE REGISTRATIONS*



U.S. Motor Vehicle Registrations, 1910-1966

*Source: Public Roads Administration (through 1930); Automotive Industries (1931-1966).

with 200 million today. By that year 125 million licensed drivers 1/ will be driving an estimated 118 million vehicles. 2/

The distribution of the automobile population by age, reflecting an average of 5.7 years, is shown in Illustration 2.3. However, in spite of this average, over 12 million registered automobiles in the nation are 10 or more years old, and about 40 percent (six million) of all registered trucks are nine or more years old. It is important to note that the "age" of the vehicle is the elapsed time from the date of manufacture to the current calendar year, while the "life" is the elapsed time from the date of manufacture to the calendar year in which it is scrapped. The average life of a vehicle is considerably longer than the average age. The most recent estimate found to be available was one made by the Automobile Manufacturers Association in the publication Automobile Facts and Figures in 1960. The AMA estimated the average life of a vehicle then to be 11 years.

Illustration 2.4 provides a comparison between personal passenger vehicles and trucks and buses for various vehicle ages. The numbers of trucks and buses in use remains relatively constant in comparison to passenger vehicles during the first ten years following manufacture.

In the absence of exceptional care, older vehicles as a class might be expected to be in poorer condition than those of more recent manufacture, and this is what the facts demonstrate. Such deterioration with age involves such processes as rusting and the oxidation of rubber, as well as factors which are related to the amount and nature of use. Representative motor vehicle inspection statistics, in fact, indicate that older cars and trucks are rejected more frequently, although it is interesting to note the large percentage of vehicles just two to five years old which are rejected.

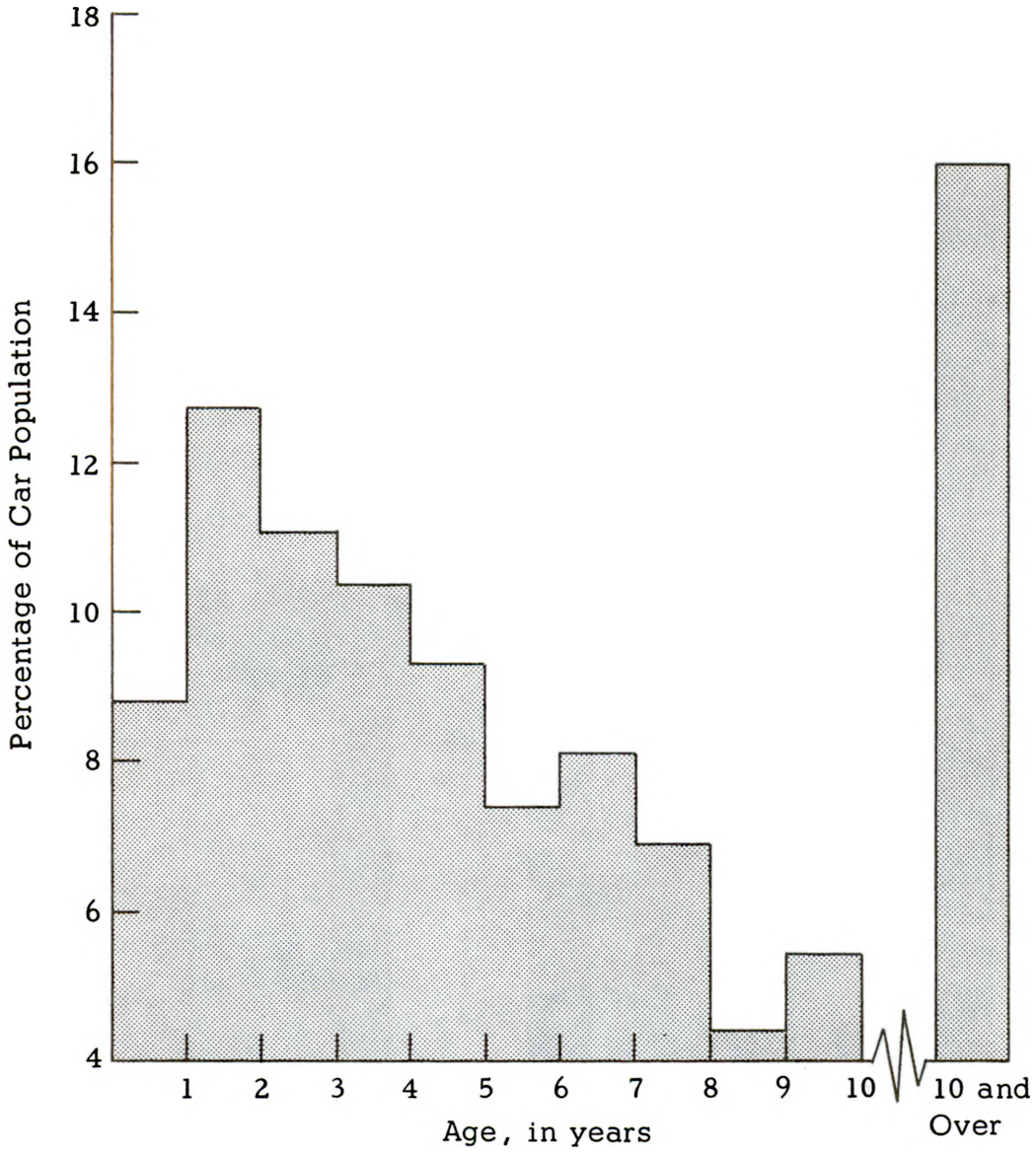
Age in Years of Vehicle	Percent Rejected
0-1	25
2-5	40
6-10	51
11 or more	53

1/ Based on a straight-line projection of recent growth in the number of licensed drivers.

2/ Federal Highway Administration, Bureau of Public Roads, Forecasting Traffic on the Interstate Systems for the 1968 Cost Estimate, February, 1967.

ILLUSTRATION 2.3

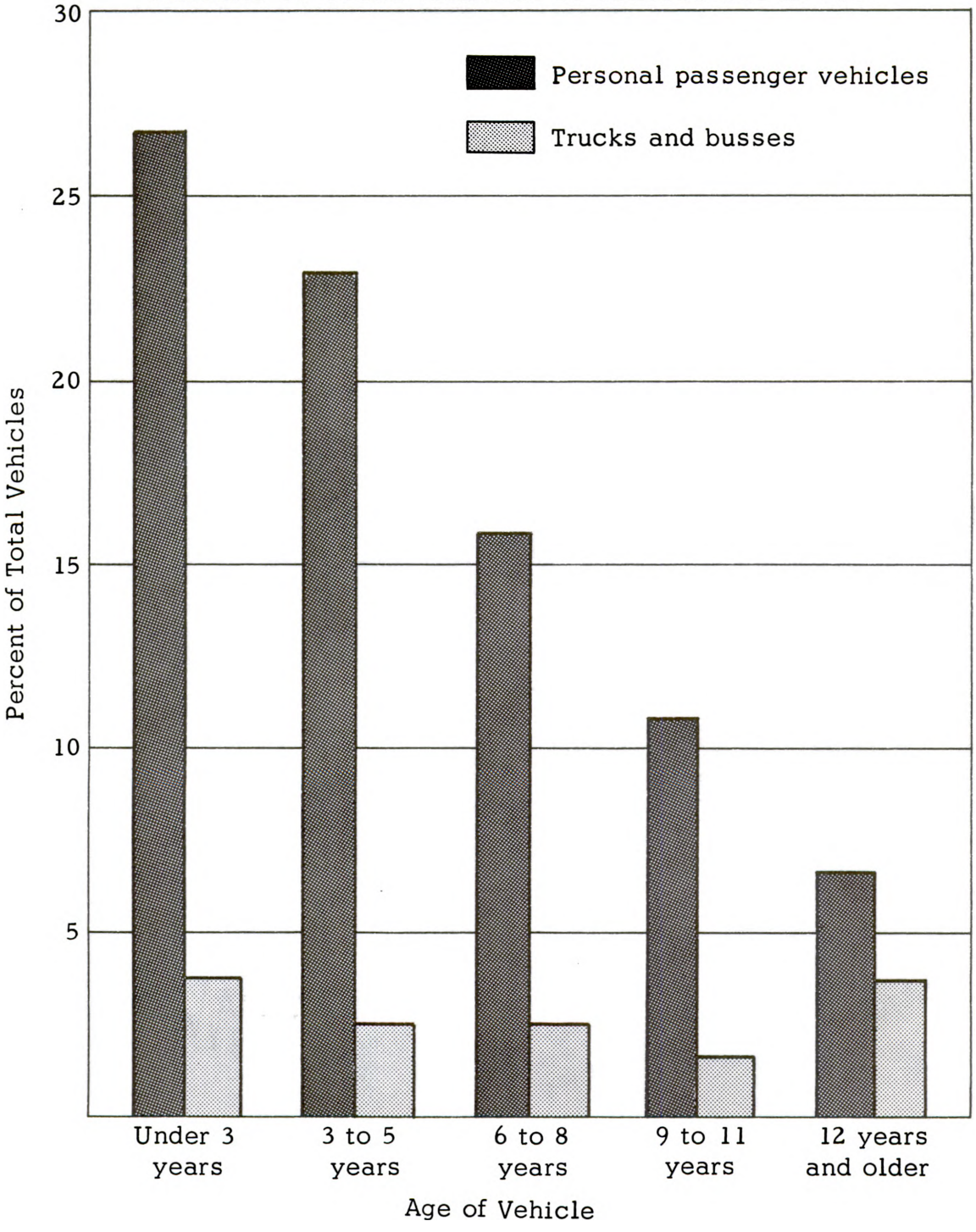
APPROXIMATE AGE DISTRIBUTION OF THE
AUTOMOBILE POPULATION
OF THE UNITED STATES, 1966*



*Automotive Industries, 15 March 1967;
data as of 1 July 1966.

ILLUSTRATION 2.4

PERCENT OF TOTAL VEHICLES BY VEHICLE AGE IN 1966*



*Prepared from data in Table 822, Statistical Abstracts of the United States, 1967; original source R. L. Polk & Co., Detroit; also 1966 vehicle registration data, cf. Highway Statistics, p. 99.

These figures are shown in greater detail in Illustration 2.5. The overall rejection rate for this sample is 42 percent. Considering the age distribution of vehicles nationwide, these results indicate that over 44 percent would be rejected.

During the calendar year 1966, approximately 43,000 trucks operated by interstate for-hire and private motor carriers were subjected to detailed inspections at roadside checkpoints by the Bureau of Motor Carrier Safety. It has been established practice in recent years for such inspections to be directed toward those vehicles which appear to be the least well maintained. Therefore, the trucks selected for inspection represent a special population, and approximately 22 percent of the "vehicle units" (trucks, tractors and trailers) inspected were ordered out of service on the spot due to extremely dangerous safety deficiencies. Their operation beyond the point of inspection was permitted only after completion of essential repairs.

Illustration 2.6 shows the approximate average miles traveled per vehicle for various types of vehicles.

Safety Implications of Motor Vehicle Inspection

The major prior attempts to establish an association between safety condition of motor vehicles and accident and death rates have largely been limited to the statistical correlation of motor vehicle inspection and death rate. 1/ Using these methods, correlations were derived for motor vehicle accident and death rates and characteristics such as vehicle density,

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1/ E. Allgaier and S. Yaksich, Factors Related to Traffic Death Rates, Highway Research Board Bulletin 142, National Academy of Sciences, National Research Council; J. L. Recht, Multiple Regression Study of the Effects of Safety Activities on the Traffic Accident Problem, National Safety Council, Chicago, Illinois, 1965; A. J. Mayer and T. F. Hoult, Motor Vehicle Inspection: A Report on Current Information, Measurements and Research, Wayne State University, Institute for Regional and Urban Studies, 1963; R. C. Buxbaum and T. Colton, "Relationship of Motor Vehicle Inspection to Accident Mortality," Journal of the American Medical Association, July, 1966; and Fuchs and Levinson, Motor Accident Mortality and Inspection of Vehicles, National Bureau of Economic Research, Inc., 1967.

ILLUSTRATION 2.5

RELATIONSHIP BETWEEN THE AGE OF CARS AND TRUCKS AND INSPECTION REJECTION RATES*

Inspection Results	Less than 1 Year Old First Inspection	1-5 Years Old	6-10 Years Old	More Than 10 Years Old	Total
Percentage of Total Vehicles Having Deficient Items					
Headlights	16.9	19.6	20.1	20.6	19.4
All other lights	4.9	12.8	2.12	23.7	15.1
Brakes	2.7	10.0	17.0	23.5	12.2
Steering operation	.4	3.3	7.7	11.5	5.0
Steering alignment	2.4	4.1	6.7	6.8	4.9
Directional signals	1.1	2.9	4.8	4.3	3.3
Windshield wipers	.2	1.4	4.5	6.0	2.6
Population Data					
No. of vehicles					
Presented	76,368	214,876	149,801	43,772	484,817
Approved	57,616	129,561	74,218	20,396	281,791
Rejected	18,752	85,315	75,583	23,376	203,026
Percent rejected	24.6	39.7	50.5	53.4	41.9

* Coverdale and Colpitts, Evaluation of MVI, 14 April 1967.

ILLUSTRATION 2.6

APPROXIMATE AVERAGE MILES TRAVELED FOR VARIOUS TYPES OF VEHICLES*

Type	Average Miles per Year per Vehicle	Percentage of Total Miles Driven
Passenger car	9,500	80.1
Motorcycles	3,900	.7
Buses, commercial	35,600	.3
Buses, school	7,700	.2
Single-unit trucks	9,600	15.2
Truck combinations	40,100	3.5
All motor vehicles	9,700	100.0

*U.S. Dept. of Transportation, Highway Statistics-1966, 1967.

population age, temperature, precipitation, registration, rural road mileage, population density, percentage urban population, per capita consumption of malt beverages, and percentage of high schools with driver education. This approach, coupled with attempts to stratify States geographically and by sociological characteristics, represents the totality of the more serious, responsible studies.

None of the authors claim to have established a watertight case, although the findings of most reports strongly suggest that motor vehicle inspection tends to reduce accidents or deaths. For example, the Mayer and Hoult study examines vehicle death rates as a function of the rigor of a motor vehicle inspection system. 1/ Their conclusion is that

> "...when the various States are categorized by inspection status on a four-point scale, there appears to be a clear relationship between low vehicle death rate and rigor of inspection system."

1/ Mayer and Hoult, op. cit.

However, the authors are careful to point out that this relationship is statistical and does not necessarily imply causality.

The second important conclusion stated by Mayer and Hoult is that

> "The extreme importance of vehicle inspection can be summarized by saying that if, between 1948 and 1960, all States had had vehicle death rates as low as those States with State-owned vehicle inspection systems, 168,381 Americans would not have died in motor vehicle accidents. This indicates that it is possible to save almost 15,000 lives a year, if we can isolate the factors accounting for the differential and apply our knowledge throughout the total United States. Is vehicle inspection a major factor? Is the differential due to some other phase of a total safety program? Or does the answer lie in the fundamental social characteristics of the population in the various States?"

Again, the authors make no claim for causality; they simply state conditionally that, if all States had death rates as low as those exhibited with State-owned motor vehicle inspection systems, many thousands of people would not have died in motor vehicle accidents. Historically, this study is representative of the state-of-the-art regarding the relationship between motor vehicle inspection and motor vehicle deaths.

Buxbaum and Colton examined "the role of mechanical failure" in automobile accidents by comparing motor vehicle mortality among males from 45 to 54 years old in States which do and do not require inspection. 1/ They concluded that "inspection is associated with lower mortality, and this association prevails under varying economic, geographic, and demographic conditions." Further, with respect to the institution of motor vehicle inspections in several States, the authors state

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1/ R. C. Buxbaum and T. Colton, "Relationship of Motor Vehicle Inspection to Accident Mortality", Journal of the American Medical Association, Vol. 197, No. 1, 4 July 1966. A later study by Colton and Buxbaum, entitled Motor Vehicle Inspection and Motor Vehicle Accident Mortality, extends this earlier study to include all age groups and both sexes. A prepublication paper on this study provided by Dr. Colton indicates the results are in substantial agreement with those presented earlier.

"Whether this maneuver reduces the possibility of collisions and thereby fatality and injury is not definitely known. Inspection regulations are not uniform nor is the frequency with which inspection is required. Thirty-four States required none, eight States and the District of Columbia required one, and eight required two inspections annually in 1960, the year on which this study is based. Surprisingly, this positive action has not been examined to determine its possible effectiveness, although interested groups support it on the assumption that it is worthwhile."

This study, which is similar in several respects to the earlier Mayer and Hoult study, still does "...not conclusively attribute motor vehicle accident mortality to specific mechanical failures."

In a later study by Fuchs and Levinson, the work of Buxbaum and Colton is extended through a multivariate analysis. One of the major conclusions is that "...this approach (multivariate analysis) cannot yield definitive results, but the evidence examined is consistent with the hypothesis that compulsory inspection reduces motor accident mortality by from five to ten percent." 1/

Because of these research deficiencies, continued work will be necessary to bridge gaps in current understanding of accidents, especially their relationship to failures of various parts of the motor vehicle. However, granted that not all of the answers are yet available, the evidence regarding the nature and prevalence of vehicle safety-related defects and of the lower motor vehicle death rates associated with inspection strongly support the Congressional decision and mandate for nationwide vehicle inspection.

1/ Fuchs and Levinson, op.cit.

III. SAFETY PERFORMANCE STANDARDS FOR MOTOR VEHICLES IN USE

Used Motor Vehicle Safety Program Elements

The two major elements of a national used motor vehicle safety effort are Federal safety performance standards for vehicles in use and State motor vehicle inspection programs to assure compliance. However, a third major element, automotive repair technology, also must be included. This element involves such issues as the licensing of repair facilities to improve quality and pricing of repairs and installation procedures, the training and possible licensing of mechanics, and dealer and garage operations in relation to manufacturer warranty practices. Closely related to automotive repair technology is the safety quality of replacement and rebuilt parts. 1/ Thus, a number of the different elements that must be considered in the development of standards for a used motor vehicle safety program are:

a. Actual performance values for such critical vehicle safety properties as braking and steering

b. Procedural inspection standards for determining compliance or noncompliance with performance values

c. Standards for licensing of repair facilities to improve the quality of repairs and installation procedures

d. Standards for mechanic skill levels

e. Standards for quality of replacement parts, either rebuilt or new

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1/ The Secretary of Transportation is required to set safety performance standards for motor vehicle equipment under P.L. 89-563, The National Traffic and Motor Vehicle Safety Act of 1966.

Without all of these elements, any national used vehicle safety program will fall short of meeting its objectives. For example, it would be futile and frustrating to require an owner to meet rigorous inspection standards in States where there are an insufficient number of properly trained mechanics to maintain and repair vehicles as required to pass inspection. Moreover, without some form of control on the quality of available replacement parts, the most skillful mechanic would be severely handicapped in completing repairs properly.

Thus, in a comprehensive program of used motor vehicle safety, all of these different types of standards are interconnected. The effectiveness of each class depends upon the others; partial approaches will not produce results up to the full potential of a complete effort.

With due recognition to the different kinds of areas that must be covered by the overall effort, this report focuses only on standards that pertain to the safety performance properties of vehicles in use, and the need for effective motor vehicle inspection by the States to implement the performance standards. All other types of related standards, such as those on quality of repairs, quality of replacement parts, or inspection procedures must be keyed to this ultimate consideration--whether the vehicle does or does not perform at a minimum level commensurate with reasonable safety.

The Nature of Used Motor Vehicle Safety Performance Standards

The problem of used vehicle safety standards begins with a fact: parts and systems inevitably deteriorate with time and use, and safety performance deteriorates with them. The problem may thus be simply stated: how much degradation of safety performance should be permitted before corrective measures are required?

The recently issued Federal safety standard on tires may serve as an illustration of one approach to this problem. The standard requires a positive, directly visible indication to be built into the tire, making it comparatively simple to recognize when the tread has worn to a depth of 1/16 of an inch. While a tire with a tread depth of 1/16 of an inch will not perform as well as one with the original tread depth, the standard in effect defines the maximum deterioration in tread depth consistent with limiting risk to a tolerable level.

More complex problems are involved in assessing the safety performance of such important characteristics as braking and steering. Brake linings and steering linkages, for example, become worn with use. Degradation of the associated safety properties is unavoidable, but there is a point at which repairs or replacement of worn parts must be made mandatory.

This point of mandatory corrective repair is the heart of safety standards for used motor vehicles. An overly conservative standard places needless economic burden upon the owner, whereas a standard that prolongs the use of worn parts, while saving on repairs, produces a concomitant increase in danger. The problem is one of achieving proper balance between repair costs and danger.

Complementary Nature of New and Used Motor Vehicle Safety Standards

While existing new vehicle safety standards are concerned with the performance of safety-related systems and parts of the vehicle at the time of manufacture, in comparison with used motor vehicle standards which must consider the deterioration of systems and parts with use, vehicle safety performance after extended use cannot be isolated from its original design at the factory. For example, the level of safety performance designed into the vehicle in accordance with applicable "new vehicle" standards is the beginning point for defining maximum permissible safety performance deterioration in a used motor vehicle safety standard. In fact, reliability of extended performance is universally recognized as one of the critical parameters of all automotive design. The now widespread extended warranty practices of manufacturers amply demonstrate industry's judgment of its ability to design for long-term performance, although for 1968 models, additional charges have been applied to second and third owners who want to retain ownership of the warranty. Under present automotive engineering practice, it is axiomatic that used vehicle safety can and must start on the new vehicle drawing board.

Although new vehicle safety standards emphasizing reliability cannot obviate the need for used vehicle standards, they can perhaps reduce the frequency with which the vehicle must be inspected. More and better emphasis on this also would have practical relevance. Where compliance with new motor vehicle safety standards rests with a limited number of manufacturers, used motor vehicle safety compliance rests with millions of consumers under the jurisdiction of State motor vehicle inspection programs, and depends on diversified automotive maintenance and repair practices in garages and service stations throughout the country, and the quality and reliability of replacement parts made by thousands of manufacturers.

Present Federal safety performance standards for motor vehicles and motor vehicle equipment establish criteria for safety performance at the time of manufacture but not for performance after substantial periods of continued use, except as to commercial interstate motor vehicles which are subject to the motor carrier inspection and maintenance requirements. The Department of Transportation will investigate the feasibility of broadening the scope of new vehicle standards to cover safety performance after periods of extended use.

Even in advance of such a study, some classes of identifiable vehicle safety properties can only be treated in new vehicle standards, whereas others are suited for treatment in both new vehicle and used vehicle standards. For example, energy-absorbing steering columns, structures to increase crashworthiness, padded instrument panels, and other similar vehicle characteristics can only be treated as new vehicle standards. Furthermore, since use would not normally cause much deterioration in these, they are not likely candidates for used vehicle safety performance standards.

On the other hand, braking, steering, lighting, wheel alignment, and suspension performance are among the obvious candidates for coverage under used vehicle safety standards because their performance properties are known to deteriorate and they should be designed with an awareness of the fact that repairs will be required during the life of the vehicle. It is also clear that vehicles should be designed to a reasonable likelihood of continued safety performance in these important characteristics, not only with normal use, but also in expectation of abuse or owner indifference to proper maintenance. Indeed, some poor repair practices can be traced to the original design which makes proper repair difficult.

The application of used motor vehicle standards, together with intensive research based on actual crashes, will always have to be the ultimate basis for assessing the actual safety qualities of vehicles in use, and for identifying the point at which the deterioration has reached a level to warrant requiring corrective maintenance. Nevertheless, new motor vehicle standards must influence original design to minimize subsequent deterioration of relevance to safety, whether it arises in normal usage or in predictable abuse.

Accordingly, the two types of standards must thoroughly complement each other. The used motor vehicle standards are the logical and practical extensions of new motor vehicle standards. Both types of standards are required, but the relationships are so close that their development must be coordinated and parallel.

The Nature of Safety Performance

The ultimate purpose of all motor vehicle and highway safety programs is to bring about substantial reductions in traffic death and injury. This may be accomplished by

a. Preventing crashes

b. Increasing survivability in the crashes that occur

c. Improving post-crash attention to crash victims

In the framework of this pre-crash, crash, and post-crash sequence, the important safety performance properties can be categorized: To cite several examples:

a. Braking and steering are prime examples of crash prevention properties

b. Occupant restraint and crash protection exemplify crash survivability properties

c. The relative ease with which doors can be opened to facilitate removal of injured occupants after a crash is a post-crash performance property

New motor vehicle safety standards are necessary in all three categories of safety performance. In illustration, among many other requirements, the initial standards issued by the Department of Transportation, effective 1 January 1968, cover the pre-crash performance properties of service brakes, pneumatic tires, and lamps; crash survivability properties such as steering control impact protection, door latches, and shoulder-lap belts; and for post-crash protection, integrity of fuel tanks.

For used motor vehicle safety standards, on the other hand, major emphasis should initially be placed on the pre-crash or accident avoidance performance characteristics of braking, steering, lighting, wheel alignment, and suspensions. Vehicle crash survivability or post-crash properties generally will not fall within the purview of used motor vehicle standards for two primary reasons. First, many of these features can only be incorporated in a vehicle during the course of original manufacture; an example would be stronger body and frame structure. Second, once such features are built into the vehicle, they normally do not deteriorate much with use; or, if they do, there is not much that can be done within reasonable economic limitations to correct the condition. There are, of course, some exceptions. For example,

the new vehicle standard requiring safety belts is a crash survivability provision that could readily be covered under a used vehicle standard, since belt fabrics can become worn to the point of ineffectiveness, and can be replaced without disproportionate cost. In general, however, crash survivability and post-crash properties will not be covered in used motor safety standards, but will have to be treated thoroughly under the new motor vehicle standards.

Safety Priority Criteria

The objectives of a used motor vehicle safety program are to identify serious deficiencies in the safety quality of the vehicle and to effect corrective measures. Deterioration in safety performance can be affected by any one or combination of a large number of vehicle parts. The difficult question is how to select for coverage by performance standards those vehicle properties that may deteriorate with use to a point of substantial danger. While no precise methods or formulas now exist to support such choices, it is clear that methods will have to focus on determining

a. The probability that a part will fail to function properly

   Of the vehicles in use on public highways, how many contain a particular safety deficiency?

b. The degree of hazard (criticality) in a deficient part

   If a deficiency exists in a vehicle, how serious is it from the safety standpoint, and what is the degree of hazard compared with that of other deficiencies? For example, loss of brakes is plainly more serious than loss of the horn.

A combination of these two factors provides a primary basis for establishing priorities. For example, parts which have a relatively high probability of failure would, if such failure were critical, constitute priority candidates for inspection.

Another factor to be considered in choosing parts and systems to be covered by standards is the relative difficulty of discovering deficiencies in such parts and systems (e.g., cost of inspection labor and tooling and the nature of the inspection required). If a fixed dollar amount is stipulated as an acceptable cost for a total inspection, the problem may be viewed as an allocation process. The question becomes: Which combination of inspection candidates results in the "safest" vehicle, given the relative safety contribution and cost of each inspection candidate within a total cost constraint?

As a start in developing the required data base to support priority judgments, the Department initiated a broad survey of existing data and expert opinion on the incidence of each mode of failure in all vehicle parts and systems, and the probable safety consequence, or criticality, of each such failure. 1/ Included in this survey were some 30 Government agencies, automotive industry associations, manufacturers, large private fleets, rental car agencies, and information clearing houses.

The results of this investigation combined with information available in relevant publications 2/ provide a basis for some initial observations. For most of the program requirements, however, wearout and failure data are extremely limited, especially for equipment related to driver vision, driver communication, the vehicle structure and enclosure, occupant support and restraint, instrumentation, and heating and ventilation. In some of these cases, the failure rates can be estimated from a combination of sources, such as the Earles, Eddins, and Jackson reliability charts and the Post Office "Schedule of Maintenance." In other cases, no useful data were found. The latter is especially the case for the increasingly complex power assist equipment being introduced on many vehicles, particularly insulation to steering and braking.

Because failure rates are of primary importance to the whole spectrum of used motor vehicle safety programs, a major effort must be launched to obtain reliable statistical data regarding the life expectancy of most of the numerous parts and systems that determine the safety quality of motor vehicles.

While extensive historical data on individual vehicle maintenance and repairs are available from large fleet owners such as the Federal Government, State and local governments, and utility firms, such information has critical limitations; most importantly, the use and maintenance of fleet vehicles are not representative of the general population and typically involve a far narrower range of vehicle types than those used by the general public.

1/ Operations Research Incorporated, An Investigation of Used Car Safety, FH-11-6522. The final report is not scheduled to be submitted to the Department of Transportation until June 30, 1968. It will be available in the Clearinghouse for Federal Scientific and Technical Information sometime after that date.

2/ U.S. Department of the Navy, Bureau of Naval Weapons, Naval Fleet Missile Systems Analysis and Evaluation Group, Failure Rate Data (FARADA) Handbook, Vols. I to IV; D. Earles, M. Eddins, and D. Jackson, "A Theory of Component Life Expectancies," 8th National Symposium on Reliability and Quality Control, 1962; and the U.S. Post Office Department, Vehicle Maintenance Handbook, Facilities Handbook, Series S-11, Washington, D.C., 1964.

The most important potential source of accurate failure data is the automotive manufacturing industry. As a result of their reliability testing and warranty data from the field, manufacturers can and do perform detailed statistical evaluations of component and equipment failures. However, this type of information has traditionally been considered confidential and is not presently available for public use. The Department of Transportation intends to exercise its authority, under Section 112(d) of the National Traffic and Motor Vehicle Safety Act of 1966, to obtain data from manufacturers on component failures on their products. 1/

An additional major source of information will be detailed statistical sampling by the Department, in cooperation with the States, of failures experienced by all vehicles in use. Motor vehicle inspections under the highway safety program standard issued 26 June 1967, also will contribute significantly to the collection of such data both for the choice and emphasis of vehicle inspection standards and procedures, and for the information of consumers as to the quality of different makes and models of vehicles. 2/

Part Failure Frequency

Based on information obtained to date on motor vehicle part failure rates or life expectancies, a simplified but usable basis for immediate development of initial used motor vehicle safety standards has been constructed. In this system, deficiency frequencies are classified in Illustration 3.1.

ILLUSTRATION 3.1

CLASSIFICATION OF DEFICIENCY FREQUENCIES

Percent of Passenger Vehicles in Use Containing the Deficiency	Failure Frequency Category 3/
Greater than 10 percent	I
5-10 percent	II
1-5 percent	III
Less than 1 percent	IV

1/ This section provides that, "Every manufacturer of motor vehicles and motor vehicle equipment shall provide to the Secretary such performance data and other technical data related to performance and safety as may be required to carry out the purposes of this Act."

2/ See Appendix C.

3/ The manner in which this frequency grouping is correlated with the criticality grouping is described in subsequent paragraphs.

Part Failure Criticality

The second major factor that must be considered in establishing candidate areas for used motor vehicle standards is the safety significance or criticality of a given failure. In determining criticality, it is assumed that failure has occured and the key questions must therefore be posed along the following lines:

a. If a tire blows out, what are the safety consequences?

b. If a steering system fails, what are the safety consequences?

A number of variables can influence the criticality of a vehicle failure, e.g., the speed of the vehicle, weather conditions, the pedestrian density, density of traffic on the highway at the time of the failure and the extent to which the crash design of the highway has been designed to handle a vehicle going out of control at the traveling speeds for which the highway is designed. Depending on the amount of information available, criticality analyses can be developed in a wide range of rigor and detail. At the lowest level of quantification, it is possible to rank various failures in terms of criticality. The next level would consist of assigning quantitative values to potential accident severity for each item. Finally, an attempt might be made to actually compute the probabilities of a vehicle being involved in accidents of different severity in terms of these variables.

Despite the importance of criticality analyses in establishing safety standards and inspection requirements for used motor vehicles, no generally accepted criteria for criticality exist today. Moreover, the reliable data needed for establishing the more quantitative types of criticality criteria are largely nonexistent. This clearly must be the subject of a high-priority research program.

The absence of the needed quantitative data limits criticality analysis to a largely subjective rank ordering. The system developed to date is comprised of four classes of decreasing criticality, described in Illustration 3.2.

Safety Priority Index

The present approach to defining areas that are candidates for standards is based on joint consideration, for all parts and subsystems of the vehicle, of the frequency of the deficiency and its criticality (importance). Using the previously described frequency and criticality ratings, a set of priority levels can be developed as shown in Illustration 3.3.

In this approach, it can be seen that a defect resulting in a very dangerous condition (Criticality Rating I) that occurs frequently (Frequency

ILLUSTRATION 3.2

CLASSIFICATION OF DECREASING CRITICALITY

Criticality Category	Characteristics	Examples
I	Condition would probably cause sudden and virtually complete loss of vehicle control or present unusually severe hazard to pedestrians, cyclists, etc.	Failure of brake pedal Breaking of steering linkage "Freezing" of wheel bearing
II	Condition substantially increases the probability of a collision, fire, or explosion, but is unlikely to cause sudden loss of control	Exhaust leakage into passenger compartment Bald tires Leaking fuel line in engine compartment
III	Condition may increase the probability of a collision or other hazard and would degrade the ability of either driver or vehicle to perform a safety function	Brake pedal worn and smooth Leaking power steering hydraulic system Defective backup lights
IV	Minor condition that presents a nuisance, distraction, or inconvenience to the driver or a minor degradation in performance or safety factors	Excessive external fumes or noise Cracked or discolored rear window

ILLUSTRATION 3.3

PRIORITIES OF CANDIDATE AREAS FOR USED MOTOR VEHICLE SAFETY STANDARDS

Criticality Rating	Frequency Rating			
	Most Frequent I	II	III	Least Frequent IV
I (Most dangerous)	A	A	B	C
II	A	B	C	D
III	B	C	D	E
IV (Least dangerous)	C	D	E	E

A—Highest priority
E—Lowest priority

Rating I) is assigned the top-priority level of A. A minor nuisance condition (Criticality Rating IV) that rarely occurs (Frequency Rating IV) is assigned the lowest priority level of E. The complete illustration provides a framework for categorizing all safety deficiencies into five priority levels as a function of their relative importance and chances of occurrence.

The assignment of a priority to each part or subsystem related to safety performance makes it possible to develop an independent list of candidate items for standards, rank-ordered in a systematic manner into safety-important categories.

It must be emphasized that the development and issuance of standards must also consider the economic and technological feasibility of implementing the standard. As a result, a complete correspondence cannot be achieved between near-term used motor vehicle safety standards and the priority levels assigned on the basis of failure frequency and criticality. For example, "about to happen" steering failures would not be detectable because there now are not practical vehicle inspection techniques to identify advanced metal fatigue in key elements of the steering linkage.

Nevertheless, a "master list" as shown in Appendix D provides a reasonable starting point to which repair and inspection costs and other important considerations can be applied as soon as relevant data are collected. This list presents only the results of the preliminary determination

of candidate areas for used motor vehicle safety standards in terms of safety priorities A to E.

Other Criteria

In addition to part failure frequency and criticality, a number of additional criteria must be applied in selecting used vehicle performance features to be covered by safety standards. In particular, there must be a reasonably complete knowledge of the testing procedures, facilities, tools, skills, and time required for each kind of test as well as the costs associated with each. There must be an examination of whether the cost of a test is so high as to preclude its inclusion in any routine inspection program. For example, critical embrittlement of a part can be detected by x-ray and other industrial methods. Even so, it is questionable whether use of this practice for routine inspection of vehicle parts is the best possible investment, in terms of safety payoff, of the additional dollars it would cost.

Another major cost consideration relates to repairs likely to be required if a vehicle fails to pass a given inspection test. For correcting some low priority items, repairs might be relatively inexpensive, while for some of high priority, they might be very costly. Again, the question is one of maximizing the payoff for each dollar spent—in this case, the consumer inspection and repair dollar.

The selection among candidate areas for coverage under used motor vehicle standards thus involves tradeoffs between the safety priority of each candidate item and its economic implications both in inspection and repair costs. Also involved in this selection process are several other considerations that are briefly described next.

Continued Performance With Time and Wear

Closely related to criticality of wear in a given part or system is the question of whether the vehicle, although in satisfactory condition at the time of inspection, is likely to become unsafe by the time of the next inspection. To avoid this problem, the standards should consider vehicle ability to operate safely at least until the time of the next inspection. For example, Federal Motor Vehicle Safety Standard No. 105 requires, in part, that ten complete stops from 60 mph be accomplished with pedal forces no greater than 200 pounds and with the stopping interval of .4 mile. The ability to successfully complete this test sequence, without swerving out of a 12-foot lane, as required by the standard, is directly related to the lining thickness.

A direct performance check on this requirement in an inspection program would be very difficult. However, it is possible to develop, for

each design alternative available to the vehicle manufacturer, a set of inspection procedures and quantitative "accept" criteria that provide the required assurance. In this case, a minimum lining thickness (or pad thickness with disc brakes) is often specified to ensure the future ability of a system to meet a performance standard. In addition to brakes, items such as tires, exhaust system, and cooling system hoses may be reasonable candidates for survivability "time and wear" standards.

Add-On and Retrofit

An important question regarding high-priority safety features involves vehicles that were not equipped with safety features at the time of manufacture. For example, a State could require that all vehicles, regardless of the year of manufacture, be equipped, by "add-on", with safety belts in order to pass inspection. Another type of change would be replacing a bulb and reflector headlight with a sealed beam type. These types of changes are referred to as retrofitting.

If used vehicle safety standards are issued that apply to safety items not generally found in older vehicles, a decision must be made about whether the standard should apply to such older vehicles. Most States have traditionally handled this by applying "grandfather clauses" under which vehicles manufactured before a specified date are exempted. However, in some cases differences between jurisdictions have led to the problem of a vehicle passing inspection in a State having a "grandfather clause" exclusion but failing to pass inspection in an adjacent State requiring retrofitting.

Some of the newly effective Federal safety standards for new motor vehicles pose additional problems. For some requirements, such as the energy-absorbing steering column, retrofit is virtually impossible, although for others, such as side mirrors, add-on is comparatively simple. In the case of others, such as seat-belts, add-ons may be very simple for some vehicles, for example cars with built-in anchorages, but somewhat more difficult for others lacking such prior provision for installation.

Any requirement for retrofit or add-on must be very carefully considered since it will have the effect of imposing an economic burden particularly on low-income groups who usually drive older cars. The cost to such owners of altering their vehicles, or of disposing of them if a change is substantial, must be balanced against the probability of the occurence and severity of crashes and injuries that might result if the change were not made.

Initial Candidate Areas for Proposed Standards

The systems and components being considered as candidate areas for proposed safety standards for vehicles in use include:

Brake systems, including brake lines, service brake system, emergency brake system, and parking brake system

Steering and suspension systems

Tires, wheels, and rims

Lamps, reflective devices, and associated equipment

Glazing

Windshield wiping, washing, defrosting, and defogging

Occupant restraint systems

Horns

Rearview mirrors

Body, doors, fenders, moldings, and bumpers

Fuel supply system

Exhaust system

Wheel nuts, wheel discs, and hub caps

This list was derived from the safety priority ranking shown in Appendix D, coupled with a preliminary analysis of economic and technical implications within the present reach of motor vehicle inspection practice. A notice of request for comments will be published in the Federal Register outlining a list of tentative candidates for motor vehicle safety standards for vehicles in use and inviting interested parties to submit comments for the record.

The goal is to have the broadest possible coverage with appropriate standards for high safety priority items on all types of vehicles, including passenger cars, multipurpose passenger vehicles, trucks, trailors, buses, and motorcycles. Furthermore, a parallel goal is for the standards to become effective as soon as possible. However, a realistic appraisal of the magnitudes and complexities of the problem indicates that coverage of all possible

types of vehicles will not be possible on a short-term basis, but rather will evolve over the next several years.

Standards for some aspects of braking, steering, suspension, and other high-priority safety items are tentatively scheduled to be issued in the Fall of 1968. Precise effective dates will depend upon the content and results of Department analyses of the technical record that will be generated in response to its Notices of Proposed Rule Making.

Department of Transportation standards for vehicle inspection, maintenance, and general safety requirements are now in effect for commercial motor vehicles engaged in interstate and foreign commerce. Responsibility for administration of these regulations, prescribed under the provisions of the Interstate Commerce Act and the Explosives and Combustibles Act, was transferred to the Department by P.L. 89-170, the Department of Transportation Act.

This stable body of motor carrier safety and hazardous materials regulations are administered and enforced by the Department's Motor Carrier Safety Bureau in the Federal Highway Administration. A substantial number of States have adopted these motor carrier safety and hazardous materials regulations in toto and made them applicable to intrastate motor carrier operations. Many other States have adopted parts of these regulations for intrastate application. Additionally, some portions of these safety requirements have been incorporated in the Uniform Vehicle Code which forms the basis for many State traffic laws.

The act creating the Department of Transportation provides that the Department may enter into cooperative enforcement agreements with the States for enforcement of the Federal and State motor carrier safety laws. However, no means were provided to increase the State or Federal capability to effectively administer and enforce these specialized inspection, maintenance, and safety requirements which are specifically designed to meet the needs of the heavy, complex, and high-mileage commercial motor vehicles.

A deterrent to the adoption of interstate motor carrier safety requirements to intrastate operations is lack of resources in some jurisdictions to carry out the necessary inspections. A Department of Transportation study is now under way to determine the means and feasibility of a grant-in-aid program to increase the State-Federal commercial motor vehicle inspection and safety enforcement capability for intrastate commercial motor vehicles operated by both for-hire and private motor carriers.

As previously discussed, programs of motor vehicle inspection will serve as the principal means for implementing standards for vehicles in use. The following chapters describe existing and proposed motor vehicle inspection programs.

IV. MOTOR VEHICLE INSPECTION

Introduction

As the safety performance of vehicle components deteriorates with time and use, the vehicle is increasingly likely to be involved in a crash. Proper maintenance and repairs can counteract performance deterioration.

The purpose of a vehicle inspection program is to decrease the number of vehicle defects that cause or contribute to collisions. If standards defining minimum safety quality are adequate and if the vehicle inspection system is able to enforce compliance, the safety quality of motor vehicles will rise. The implementation of uniform safety standards under motor vehicle inspection is the first step toward assuring the adequate safety quality of all vehicles operated on the public thoroughfares.

Typical data obtained from existing programs indicate that a substantial number of all vehicles inspected contain one or more safety-related defects. As noted earlier, a recent survey 1/ gives the following distribution:

Age in Years of Vehicle	Number of Defects per 100 Vehicles Inspected
0-1	25
2-5	54
6-10	82
10 and older	96

Although the defect rate for older vehicles in strikingly high, the substantial number of defects in the 0- to 1-year age category demonstrates clearly that motor vehicle inspection of vehicles of all ages is needed.

1/ Coverdale and Colpitts, Evaluation of Motor Vehicle Inspection, April 1967.

An analysis of available data 1/ indicates the following trends:

a. Rejection rates are high when motor vehicle inspection is first initiated in a State and tend in time to decrease and stabilize near 40 percent.

b. Rejection rates tend to be greater when there is a decrease in the number of inspections performed per year.

c. Rejection rates tend to be greater for older vehicles.

d. The approximate frequency with which various defects show up during inspection is shown in the following list in decreasing magnitude:

Lights (including headlights and directional signals)

Braking

Exhaust system

Steering and front end

Windshield wipers and blades

Tires.

An effective national program of vehicle inspection administered by the States can greatly improve the safety quality of the motor vehicle population. However, because the implementation of motor vehicle inspection programs and the enforcement of reapirs will necessarily have substantial economic consequences, it is essential to achieve the greatest possible efficiency in both the technology and administration of these programs. The goal must plainly be to detect unsafe vehicles while at the same time not needlessly rejecting vehicles in safe operating condition.

It is clear that the success of vehicle inspection depends on the efficiency and reliability of both the technical and administrative aspects of the program. The principal technical considerations include the items to be inspected, the standards that are used as criteria for rejecting a vehicle, the methods and equipment employed in performing the inspection, and the interval between subsequent inspections. The administrative considerations are just as

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1/ See Bibliography in Appendix F.

important and include such matters as whether the inspection will be performed by State-owned and operated inspection stations, by private garages licensed by the State, by a combination of these, or by some other procedure.1/ Other principal administrative requirements include the enforcement procedures to ensure that defective vehicles are repaired and that the inspection station is accurately and honestly complying with prescribed standards and procedures.

Current Motor Vehicle Inspection Programs in the States

As of 31 December 1966, 21 States2/ and the District of Columbia required periodic inspection of motor vehicles. Ten additional States3/ had enacted such legislation as of 1 January 1968. Much of this recent legislation was in response to or in anticipation of the Periodic Motor Vehicle Inspection Standard issued by the Department of Transportation under the Highway Safety Act of 1966. Various levels of random or spot check inspection are required in eight States.4/ In addition, nine States5/ have adopted the motor carrier safety regulations for application to intrastate trucking and many other States have adopted portions of these regulations.

Illustration 4.1, a map of the United States, indicates the geographical relationship of the States with various types of inspection programs. Illustration 4.2 summarizes the types of inspection programs by State as of 1 January 1968. Over 80 percent of the vehicles in this country were registered in 1967 in States which presently have a periodic or random motor vehicle inspection statute.

A survey is being performed to determine the strengths and weaknesses of State motor vehicle inspection programs. The following specific areas of interest are among those which have been established for evaluating such programs:

a. Technical considerations

Items inspected and conditions checked

1/ A recent publication in this area is Management Manual For Motor Vehicle Inspection, Insurance Institute for Highway Safety, Washington, D.C. January 1968.

2/ Colorado, Delaware, Georgia, Hawaii, Kentucky, Louisiana, Maine, Massachusetts, Mississippi, New Hampshire, New Jersey, New Mexico, New York, North Carolina, Pennsylvania, Rhode Island, Texas, Utah, Vermont, Virginia, and West Virginia.

3/ Arkansas, Florida, Idaho, Indiana, Missouri, Nebraska, Oklahoma, South Carolina, South Dakota, and Wyoming.

4/ California, Michigan, Minnesota, North Dakota, Ohio, Oregon, Washington, and Wisconsin.

5/ Arkansas, Idaho, Montana, Utah, Wyoming, North Dakota, Oklahoma, Colorado, and Arizona.

Vehicle acceptance-rejection criteria

Method of inspection or test

Inspection interval

b. Administrative considerations

Type of inspection, e.g., state-operated, etc.

Other administrative functions, e.g., compliance, licensing, etc.

Appendix E delineates the frequency of motor vehicle inspection in each State by type of inspection and jurisdiction. The summary shown in Appendix E relates primarily to the inspection of automobiles. State policies, procedures, and practices related to truck inspection vary substantially from State to State, and include self-inspection by fleet owners as well as the application of portions of the interstate motor carrier safety regulations.

Industry standards promulgated by the USASI, SAE, ASTM, and NCUTLO1/ have been adopted by many States in original or modified form for use as standards for motor vehicle inspection. These range in scope and content from standards for the vehicle (USASI, ASA D7.1), for the State-operated facility (USASI, ASA D7.2), and for the State-licensed facility (USASI, ASA D7.3) to standards for vehicular subsystems, e.g., Service Brake System Performance Requirements-Passenger Car (SAE J937), and parts, e.g., Automotive Brake Hoses (SAE J40b).

Examination of various State motor vehicle inspection programs shows that most States use the same underlying documents as the basis of the stand-

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1/ United States of America Standards Institute (USASI)
10 East 40th Street
New York, New York 10016

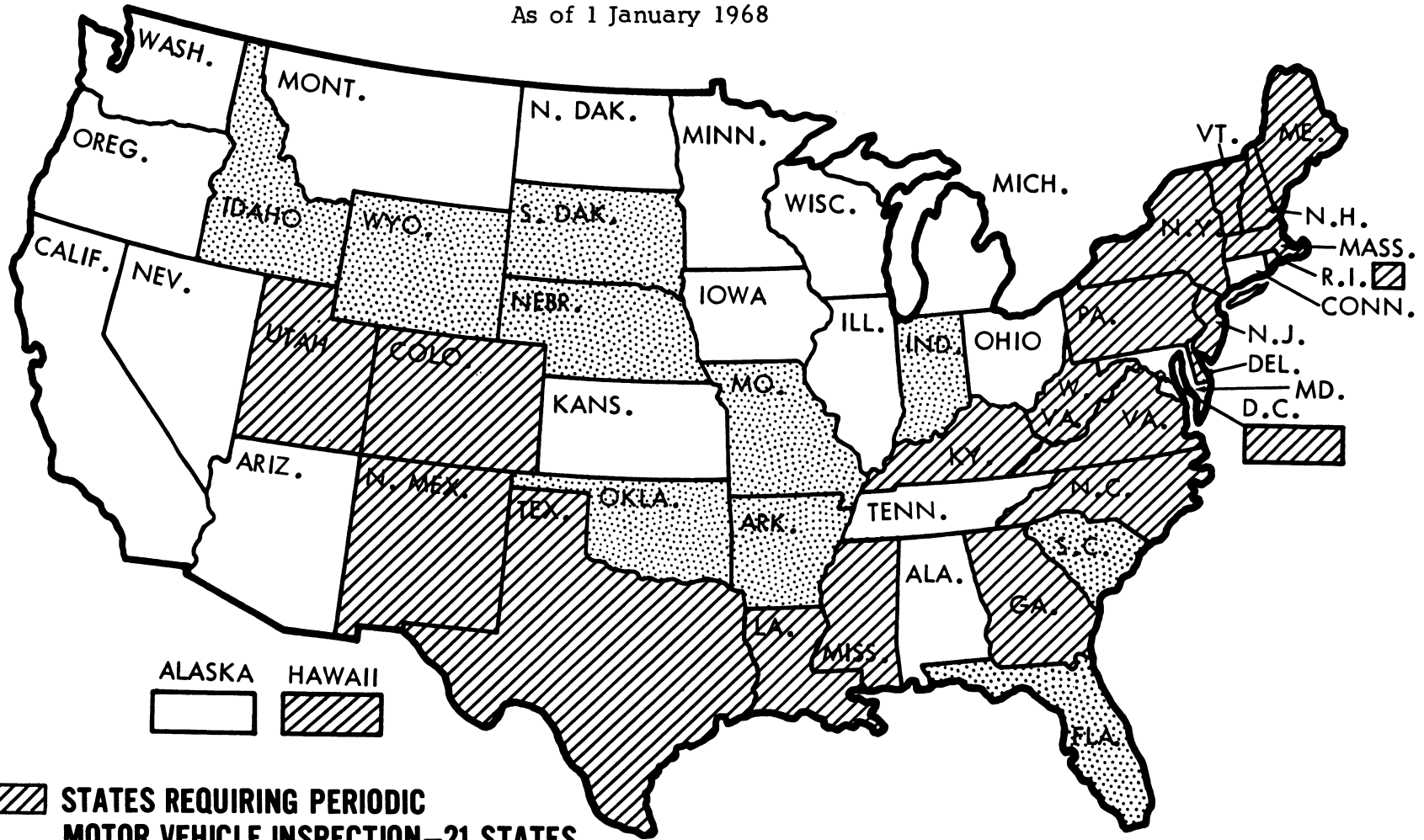
Society of Automotive Engineers, Inc. (SAE)
485 Lexington Avenue
New York, New York 10017

American Society for Testing and Material (ASTM)
1916 Race Street
Philadelphia, Pennsylvania 19103

National Committee on Uniform Traffic Laws and Ordinances (NCUTLO)
525 School Street, S.W.
Washington, D.C.

ILLUSTRATION 4.1

STATES REQUIRING PERIODIC MOTOR VEHICLE INSPECTION BY LAW
As of 1 January 1968



STATES REQUIRING PERIODIC MOTOR VEHICLE INSPECTION—21 STATES AND DIST. OF COLUMBIA AS OF DEC., 1966

STATES PASSING PMVI STATUTE SINCE JANUARY 1, 1967—10 STATES

STATES NOT REQUIRING PERIODIC INSPECTION—19

ILLUSTRATION 4.2

STATUS OF MOTOR VEHICLE INSPECTION IN THE STATES
As of 1 January 1968

Periodic Motor Vehicle Inspection		Other or No Inspection Requirements		
States Having a Periodic Motor Vehicle Inspection Statute on 1-1-67 (21 States & D.C.)	States Passing a Periodic Motor Vehicle Inspection Statute Since 1-1-67 (10 States)	States Requiring Random or Spot Checks (8 States)	States Permitting Local Motor Vehicle Inspection* Ordinances Only (4 States)	States with Limited or No Inspection Requirements (7 States)
Colorado	Arkansas	California	Alabama	Alaska
Delaware	Florida	Michigan	Illinois	Arizona
District of Columbia	Idaho	Minnesota	Iowa	Connecticut
Georgia	Indiana	North Dakota	Tennessee	Kansas
Hawaii	Missouri	Ohio		Maryland
Kentucky	Nebraska	Oregon		Montana
Louisiana	Oklahoma	Washington		Nevada
Maine	South Carolina	Wisconsin		
Massachusetts	South Dakota			
Mississippi	Wyoming			
New Hampshire				
New Jersey				
New Mexico				
New York				
North Carolina				
Pennsylvania				
Rhode Island				
Texas				
Utah				
Vermont				
Virginia				
West Virginia				

*Florida and Louisiana have Periodic Motor Vehicle Inspection and permit local ordinances. Ohio has random inspection and permits local ordinances.

ards and inspection procedures that they employ. As an example, most jurisdictions follow the USASI standard for approving glazing material.1/ Substantial differences in approach are found, however, in areas such as tire inspection, brake inspection, and in the assessment of the safety performance of steering and suspension.

The safety priority ratings described in Chapter III and listed in Appendix D were used to obtain a preliminary evaluation of the types of items inspected and conditions checked by State motor vehicle safety programs. A survey was conducted of 10 jurisdictions which contain more than 50 percent of the vehicles currently subject to periodic inspection, to determine the extent to which inspection procedures cover the items with the higher safety priority ratings. No attempt was made to assess the thoroughness of the inspection procedures. The results of this survey are summarized in Illustration 4.3.

A reasonably good correlation was found between the safety priority level and the percentage of States inspecting that item. Most States in the sample inspect for steering, brakes, tires, and lights, all of which are high-priority items; few check for power train, cooling sub-system, and certain instrumentation features that are designated as low-priority. Illustration 2.5 in Chapter II shows the percentage of defects found in the operation of a typical State-licensed program.

To date, the Department's analysis of State motor vehicle inspection program adequacy has considered primarily the elements of the vehicle which are inspected and the type of inspection facility. It is nonetheless clear that the equipment now in general use is at best marginal and this severely limits the depth, scope and accuracy of the inspections.

An effective motor vehicle inspection program requires close adherence to the letter and spirit of the inspection regulations. Such adherence was not found to be a problem in the case of publicly owned facilities (New Jersey and the District of Columbia) which have relatively few stations and are staffed by State employees. Where private garages perform the inspection under State license, the problem of ensuring uniform compliance was found to be quite serious in some cases. Not only are large numbers of garages and inspection personnel involved, but they are widely dispersed. In addition, an inspection bias arising from the interest of private garage owners in performing repairs could add substantially to the problem of maintaining consistently fair application of inspection standards. Also, the expense of maintaining adequate supervision over State-licensed garages is difficult.

1/ "American Standard Safety Code for Safety Glazing Materials for Glazing Motor Vehicles Operating on Land Highways," USASI Code Z26.1-1966.

ILLUSTRATION 4.3

SURVEY OF ITEMS INSPECTED IN 10 JURISDICTIONS HAVING MOTOR VEHICLE INSPECTION

(Percentage of vehicles for which the items, grouped by "safety priority level" as illustrated in Appendix D, are inspected)

SAFETY PRIORITY LEVEL A	
System, Subsystem, or Component	Percentage
Steering	
Linkage	60
Wheel bearings	61
Drive belt	18
Service brakes	
Master cylinder and reservoir	43
Wheel cylinder	58
Caliper assembly (disc brakes only)	14
Tires	77
Road illumination	
Headlight assembly	82

SAFETY PRIORITY LEVEL B	
Steering system	87
Hydraulic booster	23
Grease seals	0

SAFETY PRIORITY LEVEL B (Cont)	
System, Subsystem, or Component	Percentage
Service brakes	100
Shoes	44
Lines and fittings	58
Suspension	
Attachment points	53
Linkage	54
Shocks and stabilizer links	27
Power train	
Automatic transmission	0
Grease seals	0
Windshield assembly	
Wiper-washer	99
Road illumination	
Headlights	100
Communication	
Turn signals	71
Brake lights	84

ILLUSTRATION 4.3 (Cont)

SAFETY PRIORITY LEVEL B (Cont)	
System, Subsystem, or Component	Percentage
Brakelight switch	0
Running lights	100
Hood	8
Latch	8
SAFETY PRIORITY LEVEL C	
Steering system	
Wheel	75
Hydraulic pump	6
Steering knuckle	18
Spindle nut	24
Wheel studs	29
Service brakes	
Pedal	91
Linkage	40
Drum	44
Pads (disc brakes)	20
Parking brakes	62
Lever	47
Linkage	1
Shoes, etc. (drive shaft type)	0

SAFETY PRIORITY LEVEL C (Cont)	
System, Subsystem, or Component	Percentage
Wheel	56
Suspension	49
Springs	54
Power train	
Engine	0
Wheel bearings	0
Studs	11
Fuel subsystem	1
Accelerator	0
Exhaust subsystem	62
Cooling subsystem	0
Fan belt	0
Bumpers	22
Electrical subsystem	0
Battery	0
Ignition	0
Windshield assembly	
Glass	87
Windows, side	80

ILLUSTRATION 4.3 (Cont)

SAFETY PRIORITY LEVEL C (Cont)	
System, Subsystem, or Component	Percentage
Road illumination	
Headlight switch	100
Dimmer switch	49
Main structure	15
Body	22
Doors	21
Frame and panel	22
Fenders	55
SAFETY PRIORITY LEVEL D	
Steering system	
Flexible coupling	0
Gearbox	35
Service brakes	
Disc	21
Tires	
Spare wheel and tire	0
Power train	
Clutch	0
Universals	0
Differential	0
Case	9
Fuel subsystem	
Carburetor	0
Fuel filter	0
Pump	0
Tank	7
Fuel pipe	0
Cap	26
Lines and fittings	7
Exhaust subsystem	
Muffler	69
Tail pipe	53
Cooling subsystem	
Radiator	0
Water pump	0
Hoses	0
Electrical subsystem	
Starter	0
Fuses, wires, etc.	11

ILLUSTRATION 4.3 (Cont)

SAFETY PRIORITY LEVEL D (Cont)	
System, Subsystem, or Component	Percentage
Windshield assembly	53
Defroster	0
Windows, rear	80
Mirrors, rear	62
Mirrors, side	48
Road illumination	
Backup lights	20
Auxiliary lights	49
Seats and head rests	14
Seat belts and harnesses	33
Instrumentation	
High-beam indicator	38
Turn signal indicators	15
Heater	0
SAFETY PRIORITY LEVEL E	
Steering system	
Column	49

SAFETY PRIORITY LEVEL E (Cont)	
System, Subsystem, or Component	Percentage
Power train	
Gearbox	0
Propeller shafts	0
Fuel subsystem	
Intake manifold	0
Exhaust subsystem	
Exhaust manifold	25
Emission control, positive crankcase	43
Headpipe	52
Cooling subsystem	
Radiator cap	0
Thermostat	0
Electrical subsystem	
Alternator/generator	0
Ignition switch	11
Communication	
Horn	73
Reflex reflectors	40
Hazard flashers	14

ILLUSTRATION 4.3 (Cont)

SAFETY PRIORITY LEVEL E (Cont)		SAFETY PRIORITY LEVEL E (Cont)	
System, Subsystem, or Component	Percentage	System, Subsystem, or Component	Percentage
Main structure		Window-opening mechanism	1
Frame	15	Air conditioner	6
Body bolts	1		
Doors			
Hinges	17		
Crash locks	8		
Handles	6		
Hood			
Frame and panel	6		
Hinges	2		
Release	7		
Body			
Trunk	0		
Instrumentation			
Speedometer	1		
Battery-charging indicator	0		
Fuel gauge	0		
Water temperature gauge	0		

ILLUSTRATION 4.4

1967 INSPECTION STATISTICS FOR VARIOUS STATES

State	Size of Program		License Fees		Inspection Fees				Performance Bonds	
	Approx. Number of Stations	Approx. Number of Inspections Annually	Per Station	State Receipts (1) x (3)	Fee	Station Receipts (2) x (5)	State Portion	State Receipts (2) x (7)	Amount Required per Station	Aggregate Bond Expense (1) x .01(9)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	
Colorado	2,550	926,500	–	–	1.50	1,390,000	.10	93,000	–	–
Louisiana	1,564	1,231,900	$10.00	$15,640	1.00	1,232,000	.25	308,000	2,000	31,300
Maine	1,827	692,600	2.00	3,654	1.00	693,000	.10	69,000	–	–
Massachusetts	3,750	3,900,000	–	–	1.00	3,900,000	–	–	–	–
Mississippi	1,200	775,400	10.00	12,000	1.25	969,000	.25	194,000	1,000	12,000
New Hampshire	1,185	560,200	–	–	–	–	–	–	–	–
New Mexico	1,175	849,000	5.00	5,875	1.00	849,000	.02	17,000	–	–
New York	9,000	5,383,900	25.00	225,000	2.00	10,768,000	.25	1,346,000	–	–
North Carolina	537	1,822,300	–	–	1.00	1,822,000	.25	456,000	–	–
Pennsylvania	15,692	9,000,000	–	–	2.50	22,500,000	–	–	–	–
Rhode Island	1,245	374,700	5.00	6,225	1.00	375,000	.10	37,000	–	–
Texas	5,060	4,466,500	2.50	12,650	1.00	4,467,000	.25	1,117,000	1,000	50,600
Utah	1,384	428,900	–	–	1.00	429,000	–	–	1,000	13,800
Vermont	806	312,000	–	–	1.00	312,000	–	–	–	–
Virginia	2,328	3,114,600	–	–	1.00	3,114,000	–	–	–	–
West Virginia	1,283	568,600	–	–	1.25	711,000	.25	142,000	–	–

SOURCE: Operations Research Inc., Silver Spring Maryland, August 1967.

State enforcement actions directed at licensed inspecting garages vary considerably, ranging from verbal reprimand to the loss of the facility inspection franchise and/or the loss of inspector certification by individual mechanics. This problem is compounded by the fact that many States have set unrealistically low inspection fees. As a result, the licensed inspection stations experience a need to "find" repair work to avoid operating at a loss.

Statistics regarding size of program, fees paid by the public, and inspection station licensing practices are summarized in Illustration 4.4 for a representative group of States.

State Motor Vehicle Inspection Programs Under the Highway Safety Act of 1966

The Highway Safety Act of 1966 requires that "...each State shall have a highway safety program...in accordance with uniform standards promulgated by the Secretary...(which) shall include motor vehicle inspection," 1/ and provides 50-50 matching grants-in-aid to States implementing such programs. "Periodic Motor Vehicle Inspection" 2/ was one of 13 State highway safety program standards issued by the Secretary of Transportation and occupies a central position in the overall program for the improvement and control of used motor vehicle safety performance.

With the assistance of the National Highway Safety Advisory Committee, the representatives of each Governor, and other interested individuals and groups, a draft standard was evaluated and amended to yield the present standard for periodic motor vehicle inspection. Illustration 4.5 shows the process by which the present standard was established.

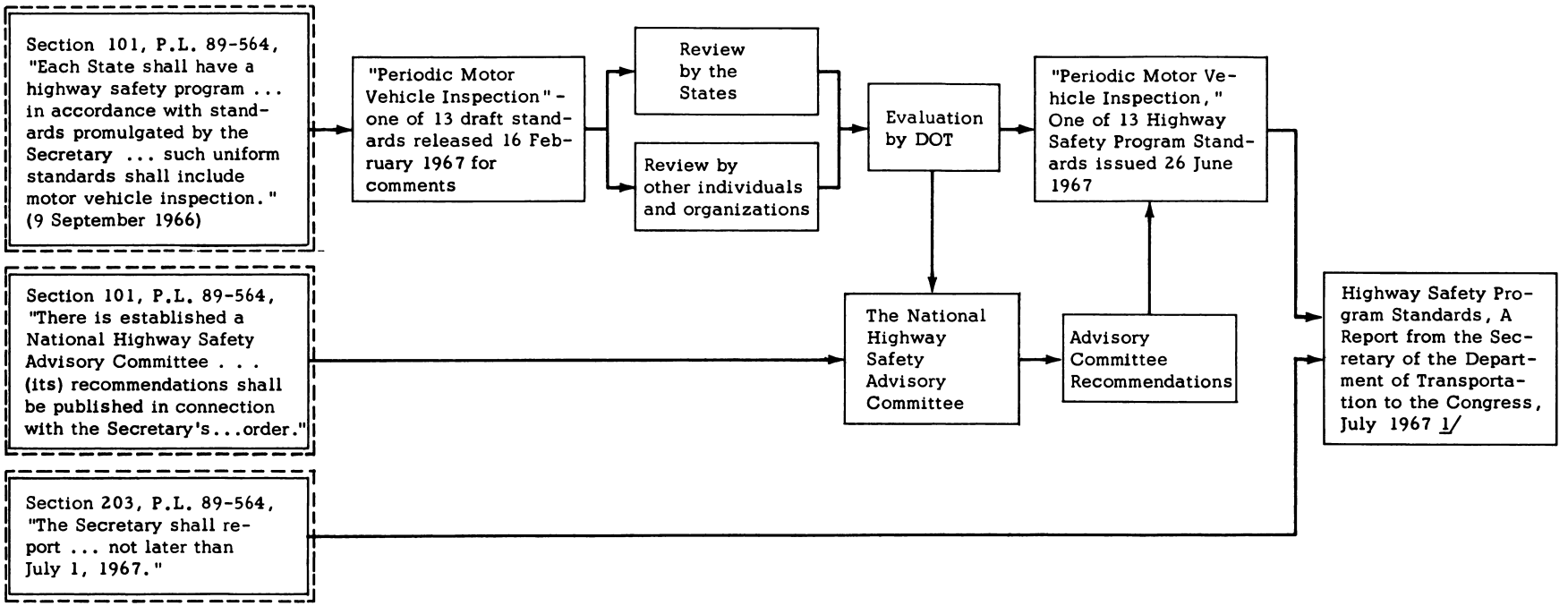
The draft standard served as a basis for a national discussion and evaluation of motor vehicle inspection by the States, private organizations, the National Highway Safety Advisory Committee, and the Department of Transportation. The recommendations of numerous organizations and the existing practices within the States were considered. The National Highway Safety Advisory Committee, whose specific recommendations by law are to be published with the final standard, recommended the following additions to the standard which were adopted by the Secretary:

a. A State should be able to have an experimental, pilot, or demonstration program in lieu of periodic inspection. An important condition for the Secretary in supporting an experimental, pilot or demonstration program is that it must include provisions for assessing the effectiveness of the requested alternative approach.

1/ Section 402, Title 23 of the United States Code (P.L. 89-564).
2/ See Appendix C.

ILLUSTRATION 4.5

AUTHORITY AND PROCESS FOR ESTABLISHING THE HIGHWAY SAFETY PROGRAM STANDARD FOR PERIODIC MOTOR VEHICLE INSPECTION



1/ Committee on Public Works, Committee Print No. 7, U.S. Government Printing Office, Washington, 1967.

b. The name of the inspector and the mileage or odometer reading of each vehicle should be recorded at the time of inspection.

c. Annual summaries of inspection records should include tabulations of the makes and models of vehicles.

In addition, the Department of Transportation has taken under advisement a recommendation by the Advisory Committee that, if inspection procedures inaugerated by a State are not approved by the Secretary, the State will not be penalized until it has had at least two years to take corrective action.

Under the Motor Vehicle Inspection Standard issued on 26 June 1967, each State is to have a program for periodic inspection of all registered vehicles, or other experimental, pilot, or demonstration program approved by the Secretary, and is to require the owner to correct any conditions which may contribute to an accident. Under the provisions of this standard, States are working to implement such activities as:

a. Requiring that every vehicle registered be inspected either at the time of initial registration and at least annually thereafter, or at other times designated under an experimental, pilot, or demonstration program approved by the Secretary.

b. Ensuring that the inspection is performed by competent personnel specifically trained to perform their duties and certified by the State.

c. Requiring inspections to cover systems, subsystems, and components having substantial relation to safe vehicle performance.

d. Establishing inspection procedures to equal or exceed criteria issued or endorsed by the National Highway Safety Bureau.

e. Requiring each inspection station to maintain records in a form specified by the State, which would include at least the following information:

Class of vehicle
Date of inspection
Make of vehicle

Model year
Vehicle identification number
Defects by category
Identification of inspector
Mileage or odometer reading.

f. Publishing summaries of records of all inspection stations at least annually, including tabulations by make and model of vehicle.

Expenditures by States and communities for vehicle inspection during 1967 amounted to $22.5 million, and are expected to increase to $96.6 in 1976. These estimates by the States do not cover the substantial cost of major improvements in equipment and facilities.

Under the matching funds provisions of the Highway Safety Act, 30 applications for Federal grants to initiate or improve motor vehicle inspection programs have been received 1/ from eighteen States, totaling approximately $2 million in Federal matching funds. Applications for additional Federal funds are rising sharply. States have estimated their Fiscal Year 1968 needs for motor vehicle inspection to be over $45 million, of which they could provide only $23 million, leaving unfunded needs of $22 million. However, only limited Federal funds will be available to assist in satisfying these needs, since new obligation authority in Fiscal Year 1968 for Federal grants to States for motor vehicle inspection, plus all 12 of the other functional program areas 2/ covered by standards as required under the Highway Safety Act, was limited to $23.9 million. The States have taken this limitation into account in deciding how much in matching dollars to request for each of the various programs.

Presently under preparation by the National Highway Safety Bureau are the technical and administrative guidelines to assist States in initiating motor vehicle inspection programs and in introducing innovations and new technologies.

Periodic Versus Random Motor Vehicle Inspection

The provision for an experimental, pilot, or demonstration program approved by the Secretary in the motor vehicle inspection standard is not an endorsement of any existing spot inspection programs. Rather, the purpose is to avoid foreclosing the search for improved inspection methods or perhaps new types of systems. However, it must be shown that experimental

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1/ As of 1 May 1968.

2/ Driver Education; Driver Licensing; Motorcycle Safety; Traffic Records; Alcohol in Relation to Highway Safety; Motor Vehicle Registration; Highway Design, Construction, and Maintenance; Traffic Control Devices; Identification and Surveillance of Accident Locations; Codes and Laws; Traffic Courts; Emergency Medical Services.

efforts are superior or at least equivalent to the required procedures in periodic annual inspections.

Another major issue in addition to the sampling rate is the quality and scope of the inspection. Because a spot inspection must be carried out in a few minutes at the edge of the highway with minimum equipment, it cannot be as thorough as that conducted in a garage, and more likely will be comparatively superficial. With the development and issuance of standards for used vehicles of increasing depth, this type of inspection will be less and less adequate, although it is possible that the rapidly evolving mobile diagnostic equipment could compensate in part for this insufficiency.

In addition to implementing the used motor vehicle safety standards, motor vehicle inspections by the States are of central importance to other aspects of the national highway safety program, such as detecting safety-related defects, reminding vehicle owners who have not done so to respond to recall campaigns, assessing the effectiveness of such campaigns, and assisting in testing for compliance with new as well as used vehicle standards, and a similar role could not be fulfilled by a random program. For example:

- The Periodic Motor Vehicle Inspection standard issued under the Highway Safety Act of 1966 requires the States to collect and publish data on safety defects by make and model of vehicle. This will provide an invaluable tool for detecting repetitive safety-related defects and informing the public of their existence, and will result in the discovery of defects early in the life of vehicles, although it will not, of course, remove any obligation from the manufacturers under the provisions of the National Traffic and Motor Vehicle Safety Act to notify owners of defects regardless of the age of the vehicle.

- With proper equipment and trained personnel, State periodic motor vehicle inspection can contribute to the determination of the degree to which new model vehicles comply with requirements in new vehicle standards issued by the Department of Transportation. These programs can accordingly be of substantial assistance in the Department's overall compliance checking program.

- Under the National Traffic and Motor Vehicle Safety Act of 1966, motor vehicle manufacturers are required to notify owners of vehicles known to contain safety-related defects, and to advise the Secretary of Transportation of the overall campaign and corrective action. Since the Department intends to supply recall campaign data to the States, periodic inspection of all motor vehicles will help to ensure that vehicle owners respond to recall campaigns, and will assist the Department in evaluating the effectiveness of such campaigns. Since the major candidate areas for used vehicle safety standards are similar to the areas that have been the subject of most recall campaigns to date, measurement tools and trained personnel should be readily available to identify defective performance in these critical areas of vehicle safety.

- In the future, new vehicle standards will emphasize the reliability of safety-related vehicle components and systems. The ultimate test of this reliability must be the actual operating characteristics of the vehicles in normal use. Periodic motor vehicle inspection may thus be used to determine the effectiveness of reliability aspects of new vehicle standards.

While spot vehicle checks are not well suited to providing these benefits, if sufficiently thorough, such inspections may provide a valuable supplement to periodic motor vehicle inspection. There are some specific supplemental benefits of spot-checking procedures that should not be overlooked:

- Since it is not possible to anticipate the exact time of inspection, it is not possible to "prepare the vehicle for inspection (and disregard its safety performance at other times).

- Since vehicle components and systems degrade with use, there are instances in which safety-related components will be satisfcatory at the time of one periodic inspection but may become hazardous before the next inspection. Spot-check systems supplementing periodic motor vehicle inspection might encourage owners to increase the servicing of their vehicles and the correction of such defects before they become critical.

In one safety area of major importance, there is no effective substitute for random spot checks. This relates to truck-axle load limitations and to determination of the effectiveness of motor carrier inspection and maintenance regulations. Clearly a motor carrier would not submit a truck, bus, or truck-trailer combination that he knew was overloaded, or in an unsafe condition, or was in violation of any other regulations for official inspection. Enforcement of these requirements can only be accomplished with spot-check procedures.

Thus it is quite likely that State motor vehicle inspection programs will evolve, as some already have, into combinations of both periodic and random inspections, the periodic procedures to ensure a complete scope of coverage, and the random methods to deal with these safety factors that should be checked without advance notice.

States that are interested in experimenting with different types of vehicle inspection programs may do so, but within the context of a preplanned program that will permit a proper evaluation to be made of the experimental methods. For example, such a plan must provide for demonstrating that equivalent or better performance is achieved, based on valid statistical proof as to the exact kinds and percentages of vehicles reached, and under what conditions, and the specific defects found and the extent of their subsequent correction.

Consolidated Motor Vehicle Inspection

The importance of State motor vehicle inspection programs for the used motor vehicle safety efforts under the provisions of both the National Traffic and Motor Vehicle Safety Act and the Highway Safety Act is unmistakable. Equally clear is their importance in enforcing the vehicle exhaust control provisions of the Clean Air Act.1/ A third area of importance encompasses inspections of motor carrier vehicle safety, including weight/horsepower ratios and statutory axle load limits for trucks and buses. Readily identified are several compelling reasons for meeting this multiplicity of requirements in each State in a consolidated motor vehicle inspection program without wasteful duplication.

Inspection and measurement of engine exhaust emissions are of central importance in the enforcement of provisions limiting the degrading pollutants that a single engine can add to the total environment. Similar inspections are also of critical importance for detection of dangerous exhaust gases in potentially lethal concentrations to children (if not adults) which escape into the passenger compartments of vehicles. No one today can reliably estimate how many of the unexplained single-car accidents, that in 1967 produced 18,800 or over 35 percent of all traffic fatalities, were due to faulty exhaust systems.

1/ Air Quality Act of 1967, P.L. 90-148

The easy and pat explanation "fell asleep at wheel" should, in some cases, have been "gassed at the wheel," but this cannot be proved without appropriate laboratory, postmortem analyses.1/ Consideration is being given to the development of a vehicle inspection test for the presence of exhaust gasses in the passenger compartment.

An engine that is idling does not produce the same quantity and quality of exhaust gases as it does when it is operating at high speeds, accelerating, or decelerating. Thus, in order to assess properly the engine's exhaust contributions to atmospheric air pollution as well as its potential immediate danger to the driver and passengers, it must be operated during the course of inspection procedures over a wide range of accelerating and braking conditions. Engine testing over a full range of operating conditions is also required for measuring the horsepower of a truck engine to check for compliance with any weight/horsepower limitation that a State is enforcing.

Thus, for all three regulatory purposes (prevention of air pollution, protection of drivers and passengers from dangerous exhaust gases, and enforcement of weight/horsepower limitations on trucks), full-range engine testing and exhaust gas evaluations are required. For all three requirements, the importance of careful engine inspections becomes more pronounced as the vehicles get older.

Today, almost no State has a fraction of the equipment and physical facilities needed for any one of these purposes. Some form of Federal assistance will be required, at least for financing the initial capital outlay for equipment. However, any program of Federal assistance should deal with requirements for inspection of all types of vehicles for all purposes in a unified manner, since much of the equipment need is identical for all of these purposes.

In addition to inspection equipment and facility costs, proper servicing of consumer needs is another very important reason for a unified approach to Federal standards for State motor vehicle inspections and the associated grant programs to help the States implement the standards. By every criterion of reasonableness and cost, including avoidance of wasteful duplication of administration, the vehicle owner should not routinely have to make separate trips to motor vehicle inspection stations to meet multiple inspection requirements stemming from different Federal laws.

1/ The commonplace conclusion "fell asleep" is seldom supported by any adequite evidence, such as the testimony of witnesses, and there is no way to determine by examining the corpse whether the driver fell asleep. Crashes due to the effects of carbon monoxide appear, on scanty research evidence, to predominantly involve sober drivers and not, for example in the case of single-vehicle crashes, the approximately two-thirds of fatally injured drivers who have been drinking heavily.

Thus, when vehicle exhaust emissions from the tailpipe are inspected under the provisions of the Clean Air Act, they should also be inspected for possible entry into the passenger compartment under the used motor vehicle safety provisions of the National Traffic and Motor Vehicle Safety Act. And while the vehicle's exhaust systems are under scrutiny for these purposes, its braking, steering, lighting, and other systems related to the rest of the used motor vehicle safety standards should be undergoing the appropriate inspections.

Public acceptance of motor vehicle inspections is important for their success but is not readily achieved, since these programs are inherently regulatory and, moreover, have a direct and immediately visible impact on the individual. A multiplicity of costly, time-consuming trips to inspection stations for different purposes that could be accomplished in a single, well-organized inspection cannot but hinder consumer acceptance of vehicle inspection.

It seems clear that a single, well-organized inspection covering numerous purposes will justify more extensive, and probably more expensive, inspection equipment than can be supported solely for any single purpose. With better equipment, the quality as well as speed of inspection will be improved. In addition, whatever the split might be between the State and the consumer, the inspection cost burdens will be less than the aggregate of numerous independent inspection costs.

Notwithstanding the obvious economic and convenience benefits of a consolidated motor vehicle inspection program, the unit inspection cost burden may increase as additional inspection requirements are enforced. Although some of this additional cost burden can and probably will be absorbed by Federal grants or State matching funds, some form of additional direct or indirect charge to the owner appears unavoidable.

This leads to the proposition that in order to compensate, at least in part, for any additional inspection cost burdens placed upon the consumer (with the implementqtion of expanded used motor vehicle safety programs, clean air programs, or projected weight/horsepower programs for trucks), the form, substance, and tone of motor vehicle inspections should be shifted <u>from consumer regulation and concomitant punitive action to service and concomitant reduced operating costs</u>.

Under this recommended shift in orientation, the vehicle owner would receive, apart from any orders to correct safety or air quality deficiencies, carefully prepared diagnostic reports on engine and vehicle performance relating to economy of operation. Since all gauges and dials (and in some cases large, specially located meters), are usually within a customer's view and all operations can be observed, there is an absence of much of the frustration and suspicion that surrounds automotive service diagnosis. Surveys

conducted by existing diagnostic centers show that most customers who have been exposed to this new concept are satisfied with the impartial, scientific approach, and with the results obtained. Whether he buys all, part, or none of the repairs recommended, the motorist develops a belief that here, at last, is a scientific service to keep him in touch with the technological advances going on around him. With proper inspection and diagnostic equipment, these reports could be provided at very little time and cost above that required for safety and air quality purposes. For example, they could indicate to the owner situations in which minor engine tune-ups would produce substantial savings in fuel costs. Furthermore, they would provide the consumer with an impartial objective check on the adequacy of repairs for which he had already paid.

The assumption underlying this recommended shift in motor vehicle inspection procedures and change in emphasis from consumer regulation to consumer service is that the consumer will be more willing to pay increased inspection charges for safety and air quality services to reduce operating costs and to help ensure that proper automotive repairs are provided at the same time.

Thus, motor vehicle inspection programs should emphasize two areas: first, the development and implementation of a consolidated unified approach that covers all requirements, whether of the State or of the Federal government, and second, the development of unified inspection and equipment technologies that will enable orientation to be shifted from consumer regulation to consumer service and yet accomplish all regulatory purposes.

Capital Requirements for Motor Vehicle Inspection Facilities

The magnitude of the investment in new and improved motor vehicle inspection facilities depends on a number of technical and administrative considerations, including the nature of the inspection tasks, the degree of reliability and sensitivity demanded, the level of service and convenience to be provided to the vehicle owner, and the adequacy of existing facilities. The fact that emerges from an examination of existing programs is that a substantial capital outlay for equipment and facilities will be needed if compliance of significant standards for vehicles in use is to be enforced by motor vehicle inspection, and the investment will be substantial whether the facilities are publicly or privately financed.

The need for better inspection equipment can be identified readily. Present programs, most of which were begun in the early 1930's as noted in Illustration 4.7, utilize relatively rudimentary methods of inspection that reflect the technology of that day. For example, stopping distance criteria are based on the slow road speeds of 15 to 25 mph, which were common 40 years ago. While these tests might have been adequate during the 1930's, they are not suitable for testing the brake performance of vehicles that travel on modern highways and freeways at speeds of 65 mph. Nor can important brake characteristics, such as fade and dynamic stability, be readily determined by the test methods now in use.

ILLUSTRATION 4.6

STATE MOTOR VEHICLE INSPECTION PROGRAMS

DATES OF INITIATION

State	System Initiated	State	System Initiated
Alabama	**	Montana	**
Alaska	**	Nebraska	1967
Arizona	**	Nevada	**
Arkansas	1967	New Hampshire	1931
California	1967	New Jersey	1938
Colorado	1935	New Mexico	1953
Connecticut	**	New York	1953
Delaware	1933	North Carolina	1967
District of Columbia	1938	North Dakota	1967
Florida	1967	Ohio	1967
Georgia	1965	Oklahoma	1967
Hawaii	1961	Oregon	1967
Idaho	1967	Pennsylvania	1929
Illinois	**	Rhode Island	1958
Indiana	1967	South Carolina	1967
Iowa	**	South Dakota	1967
Kansas	**	Tennessee	**
Kentucky	1966	Texas	1951
Louisiana	1961	Utah	1935
Maine	1937	Vermont	1935
Maryland	**	Virginia	1932
Massachusetts	1929	Washington	1967
Michigan	1966	West Virginia	1951
Minnesota	1967	Wisconsin	1967
Mississippi	1961	Wyoming	1967
Missouri	1967		

**State does not have either a periodic or random motor vehicle inspection program.

In addition, the common practice today of inspecting a stationary vehicle under static test conditions will produce results that can only partially predict what the vehicle's safety performance will be at high speeds on the highway. For example, most State inspection procedures now in use provide for little, if any, determination of whether or not a vehicle has a defective or weak brake shoe return spring. Such a condition can, over a short period of time, cause a shoe to drag and produce excessive drag and wear. This in turn can cause poor braking action on that wheel or apparent seizing of the other wheel and the resultant high probability of a serious accident. However, spotting a defect of this nature is well within the capability of modern technology; a diagnostic brake analyzer dynamometer would test for it as part of a broad array of dynamic tests on proper wheel balance, operation of steering, and the power train.

It is important to note that improvements in vehicle safety inspection can also be realized by modifying the vehicle itself to be capable of receiving more advanced inspection equipment. For example, new built-in test points, such as hydraulic brake line test points for a system pressure leak test or manifold check points for emission sampling would greatly facilitate these inspections. Brake systems might be set up to furnish a visual readout of remaining brake lining thickness and of brake fluid levels.

Many other aids, such as special wiring, connectors, and sensors for use with automated testing equipment, can be incorporated in the original design of the vehicle. In addition to facilitating the subsequent periodic inspection of the vehicle, they can appreciably relieve the skilled mechanic shortage, provide improved checking during production and assembly, and resolve many of the maintenance problems and repair costs related to the inability of an average mechanic to correctly identify the reasons for poor performance of the vehicle.

In addition, a number of new inspection techniques offer marked promise for adaptation to motor vehicle inspection, such as inspection of the underbody by TV camera and of an exhaust system by mechanical "sniffing" devices that are in common use in the aerospace industry. A number of manual inspection items that are time consuming and limited to visual inspection also could be automated, even including such difficult tasks as detection of cuts and abrasions on tires. This might be accomplished with sonic or other devices that could automatically detect a cut or abrasion in the sidewall or tread.

As travel increases on high-speed arterial highways, the need for certifying the road-worthiness of the vehicles traveling these roads also increases. Correspondingly, inspection procedures must change from the simple and unreliable visual inspections of the past to meaningful dynamic testing procedures consistent with characteristics of modern high-speed travel.

In a recently completed contract study for the Department of Transportation, 1/ an analysis was made of the cost of several different levels of nationwide inspection facilities. The minimum level considered was the manual inspection station. In operation, it would be more efficient than the best of the existing inspection stations, but nevertheless would be very similar in basic testing ability. The second level of inspection station considered was the semiautomated facility, which does not require any design changes in the vehicle in order to operate at maximum efficiency. The inspections which could be accomplished with semiautomated facilities would be about 30 percent better than those performed in a manual station. It is estimated that nationwide operation of these systems could begin in mid-1970 if the development and planning program were initiated in mid-1968.

To operate the manual inspection system, minimum equipment would include only such items as a pit or hoist, air jacks, scales, head light tester, front end aligner, and pull scale. The semiautomated system would include more complex equipment, such as a dynamic brake analyzer, force transducer, tire balance transducer, shock absorber tester, headlight photoelectric tester, and front end dynamic analyzer. Existing diagnostic centers in the United States can perform at some level between the manual and semiautomated inspection stations considered in the study.

It is roughly estimated that the minimum cost of inspection equipment and facilities to implement an efficient manual motor vehicle inspection system nationwide would fall within the range of $400 million to $600 million. For semiautomated facilities, which are today technically feasible and would utilize much of the rapidly burgeoning diagnostic techniques, the minimum cost range would be $600 million to $800 million.

In arriving at these estimates, certain assumptions were made regarding the equipment needed for proper testing of brakes, steering, lighting, and other important safety-related aspects of a vehicle, and a number of factors were considered, such as procurement of land, buildings and utilities, parking lots and paving, training manuals, regional driving conditions, and frequency of inspection.

The variations in population density throughout the United States were taken into account by considering stations in three categories: (a) those for rural areas, (b) those for towns, and (c) those for cities. For rural areas, the population was estimated to be under 10,000; for towns, a population of 10,000 to 50,000 was assumed; and for cities, a population of over 50,000. Provision was made for assuming a moderate growth factor for each type of station.

1/ "Automated Diagnostic Systems—Vehicle Inspection", TRW Systems Group, Redondo Beach, California, 26 March 1968.

An immediate question that arises is the degree to which existing facilities could be utilized or adapted for performing motor vehicle inspection services, thus reducing the initial capital outlay required. On the surface, this possibility would appear to offer an attractive alternative in light of the fact that, in the United States today, there are some 365,000 repair and inspection installations of varying size and complexity. These range from corner garages to automobile dealerships to sophisticated diagnostic centers. However, aside from the extreme variations in capability, most of them would not be able to perform all of the inspection services at the manual level, and very few could inspect for any advanced level of used vehicle safety standards.1/

The situation is not substantially better with regard to existing State motor vehicle inspection facilities which might be suitable for the minimum, or manual, level of inspection. Only a few States have facilities that could be utilized immediately for the full level of manual inspections; none can meet the semiautomated criteria.

With modern inspection equipment, reductions should be realized in inspection costs coupled with an improvement in the accuracy and reliability of the inspection. The savings, it is estimated, should more than offset the cost of the equipment. Furthermore, the facilities and equipment cost per vehicle inspected is low because the volume is large. For the minimum investment level of $400 million, the cost would be less than 40 cents per vehicle per year assuming that each of the 100 million vehicles is inspected annually, and that the facilities and equipment is amortized over a 10-year period. With the anticipated growth in the vehicle population, the unit cost might be even lower.

Regardless of the exact cost, it is clear that the significant advantages of modern technology cannot be brought to bear on used vehicle safety without an appreciable capital investment in inspection equipment and facilities. The question that remains to be answered is whether we are willing to make such a national commitment.

1/ Approximately 40 to 50 diagnostic centers have been constructed in the country in the last few years, a number of them at a cost in excess of $350,000. In a recent report on the future of diagnostic centers, the Stanford Research Institute predicted the possibility of as many as 15,000 major automobile diagnostic centers by 1975, and perhaps as many as 150,000 small diagnostic operations.

V. AN EXPANDED ROLE FOR STATE AND LOCAL GOVERNMENTS IN USED MOTOR VEHICLE SAFETY

Periodic motor vehicle inspection programs in the States, described in Chapter IV, comprise the most important single element of the national effort to improve the safety qualities of used motor vehicles. This chapter describes the critical roles the States must play in areas other than motor vehicle inspection.

State Role in the Development of Federal Programs

The States have traditionally been the laboratories in which important public programs have developed. In social legislation, in the regulation of business, and in the protection of individual rights, the pioneering activities of individual States have paved the way for major Federal programs. Similarly, in the highway safety area, the experience of the States over the years is and will continue to be the single most important information resource.

The statutes give express recognition to the role of the States in the formulation of Federal programs.

- Under the National Traffic and Motor Vehicle Safety Act of 1966, the Secretary is authorized to cooperate with the States, as well as with other interested public and private agencies in the planning and development of

  a. Motor vehicle safety standards

  b. Methods for inspecting and testing to determine compliance with standards.

- Moreover, in prescribing standards, the Secretary is directed to consult with the Vehicle Equipment Safety Commission "and such other

State or interstate agencies (including legislative committees) as he deems appropriate." Finally, the National Motor Vehicle Safety Advisory Council, with whom the Secretary consults regarding vehicle safety standards, includes representatives of State and local governments.

- Under the Highway Safety Act of 1966, the Secretary is required to develop standards in cooperation with State and local governments, among others. The National Highway Safety Advisory Committee, which advises, consults with, and provides recommendations to the Secretary relating to the Department's highway safety functions, includes representatives of State and local governments, including State legislatures.

In respect to the standards for new vehicles and for State highway safety programs which have already been issued by the Department of Transportation, many States have devoted considerable effort to commenting on both the technical aspects and the feasibility of implementing the various standards. In addition, through associations of State officials, such as the Vehicle Equipment Safety Commission, the American Association of Motor Vehicle Administrators, the International Association of Chiefs of Police, the American Association of State Highway Officials, and others, a number of important suggestions for amending proposed standards have been made.

State Role in Collecting Basic Data

Motor Vehicle Registration

Although motor vehicle registration records and traffic records have been maintained by most States for a number of years, the purpose of the national highway safety program standards is to ensure a basic minimum uniformity among all States in the type of information gathered and its accessibility and compatibility.

The vehicle registration standard issued under the Highway Safety Act provides a means for rapidly identifying every vehicle licensed to operate in a State and for aggregating such data for research, accident investigation, and enforcement purposes and for the planning and development of streets, highways, and facilities for the vehicle inspection. Under this standard, States are working to implement such activities as:

- Ensuring that every vehicle operated on public highways is registered and that identifying

information is readily available for each vehicle, including vehicle make, model, body type, identification number, and license plate number, as well as name and address of current owner, and, for commercial vehicles, gross laden weight.

- Improving registration record systems to provide:

  a. Rapid entry of new data into the records or data system

  b. Rapid response to priority requests for status of vehicle possession

  c. Data for statistical compilation.

State and local governments spent $112 million on registration programs in 1967. It is estimated that the cost to all States of complying with the standard in 1976 will be $186 million.

State Traffic Records

The traffic records to be maintained by the States, in cooperation with their political subdivisions, under the highway safety program standard will ensure that reliable information is maintained on drivers, accidents, and highways in addition to the information on vehicles supplied by the registration program. The standard requires that each State have a program for analyzing these records to identify short-term changes and long-term trends in the magnitude of traffic crashes, establishing their probable causes, and for effecting improvements to reduce accident rates. The States are also responsible for improving existing information systems and developing new Statewide systems for collecting, tabulating, and interpretively analyzing a broad array of information, for example,

- Information on vehicles and system capabilities from the motor vehicle registration program.

- Information on driver and system capabilities:

  a. Positive identification, current address, and driving history

  b. Rapid entry of new data into the system

c. Ready identification of drivers for enforcement or other operational needs.

- Information on types of accidents:

  a. Identification of location in space and time

  b. Identification of drivers and vehicles involved

  c. Description of crash, injury, and property damage, environmental conditions, and condition of the vehicle, including the absence of or failure to use available safety equipment.

State and local governments spent $61.3 million on this high-priority program area in 1967. State expenditures were $33.6 million, with $27.7 million being spent by local agencies. It is estimated that the cost of complying with the standard in 1976 will be $130 million.

Data Uses for Improving Used Vehicle Safety

Once the States have had the opportunity to organize their information gathering activities and systematize their data so that it can be fed into the National Driver and Vehicle Information Register and the National Accident and Injury Information Register, 1/ the States, individual owners or buyers, motor vehicle dealers, and manufacturers will have available, for rapid retrieval, the type of information needed to effectively decide how to invest resources most economically to achieve the maximum safety payoff.

For example, a sophisticated system with rapidly available information could provide a potential used motor vehicle buyer at the point of purchase with the history of the vehicle from the time it was first purchased, including a description of damage incurred in accidents, failure to pass inspection, involvement in a defect recall campaign, or prior ownership. Since such information could also be presented to consumers by make, model, and accident experience, manufacturers should be far more inclined than at present to find value in competing. Competition to provide superior safety qualities in their vehicles would be enhanced.

1/ Being established under the National Traffic Accident and Injury Analysis Center in the National Highway Safety Institute, National Highway Safety Bureau

The implications of the availability of such information in terms of judging the reliability of motor vehicle inspection are significant. For example, if the State's traffic records data show that the brakes of a vehicle involved in a crash failed immediately prior to the crash and that the vehicle had recently passed inspection, which included a check of braking performance, action to test the validity of the inspection station's brake test clearly would be indicated. A comparison of vehicles involved in crashes against the inspection reports could serve as a continuing measure of inspection program effectiveness. In addition, the State traffic records can provide the information needed to sustain a requirement that all vehicles involved in crashes of a specific magnitude, for example, crashes reported to State authorities, be certified by motor vehicle inspection prior to future use on the public highways.

The motor vehicle registration programs provide additional benefits for the used motor vehicle safety program. By requiring all vehicles in a State to be registered, the State can prohibit the operation of vehicles that do not pass motor vehicle inspection. These records should also be useful in the preparation of a detailed inventory of the motor vehicle population. Such an inventory is a prerequisite to the planning and implementing of a large-scale effort to improve the safety quality of motor vehicles and can also serve as a baseline against which to measure improvement.

Also, for those States currently without established motor vehicle inspection programs, motor vehicle registration records, particularly those that have been computerized, can serve as the record-keeping basis for the inspection program.

When a car is sold, it must be reregistered. Not only can definitive information concerning the volume of vehicles that change ownership during a year be found in the State vehicle registration records, but the requirements for reregistering a car when it is sold can also be used to ensure proper inspection to prevent the sale of vehicles that do not meet used motor vehicle safety standards.

New State and Local Programs

Periodic motor vehicle inspection, motor vehicle registration, and traffic records are the three major program areas currently being implemented by the States which are of immediate relevance to used motor vehicle safety. A comprehensive national effort will, however, require a number of additional areas of operational activities. This requirement lends additional emphasis to the view that the used motor vehicle safety effort will have to be mounted in large part by State and local governments, albeit with substantial Federal assistance.

Some of these required new efforts involve Federal jurisdiction or sponsorship. For example, interstate marketing practices to evade vehicle

inspection should be Federally prohibited with State assistance. However, many unexplored areas in used motor vehicle safety programs should also be under State and local jurisdiction with coordination and guidance under minimum national standards. One major area that requires attention is the entire complex of automotive repairs and maintenance:

- Dealer and repair shop operations including the impact of manufacturer warranty practices.
- Quality and pricing of repairs and installation procedures.
- Training and licensing of mechanics.

Another closely related area is the complete range of consumer protection practices. 1/ Plainly, the prospective purchaser of a used motor vehicle is entitled to assurance that the vehicle meets a reasonable level of safety quality. Possibly the most general need in the area of consumer protection is to provide him with information regarding the safety quality and associated state of repair of any vehicle he considers purchasing.

Controls on the safety quality of vehicles resold as used vehicles by dealers could be added to the motor vehicle inspection standard, as could a requirement, as noted previously, that every vehicle involved in a serious crash be reinspected before it is again operated on a public thoroughfare. Similarly, programs for utilization of the information generated by the State programs can be developed as refinements of existing standards.

Active and vigorous participation by the States is essential for a national used vehicle safety effort. That participation should be encouraged and strengthened—and supported by a major Federal grant-in-aid program under the Highway Safety Act. The Department of Transportation intends to make every effort both to ensure the States the flexibility of approach necessary to obtain the best safety results under varying local conditions and to obtain for the national program the advantages of State experience and innovation.

1/ See Chapter VI.

VI. THE CONSUMER INTEREST

Previous chapters of this report have dealt with the problems of ensuring safety in used vehicles and the programs that will provide the major components of the effort to resolve those problems. It is appropriate, however, to devote special consideration to the impact of these programs on the individual citizen who plays two primary roles:

- As vehicle purchaser and owner, he has an economic interest in keeping the initial cost and maintenance costs of his vehicle as low as possible

- As a driver, passenger, or pedestrian, he is interested in preventing vehicle crashes.

Used vehicle safety programs will require a balance between these interests. While the public is presumably willing to pay for safety—both directly, in the form of inspection fees and repairs to defective parts, and indirectly, in the form of Government expenditures—it must also be given assurance that it is getting value for its money in the form of increased safety.

The most careful consideration must be given to striking a balance between cost and safety in the used vehicle safety effort. Aspects of this balance which deal with inspection costs and costs to the Government are treated elsewhere in this report. This chapter focuses primarily on the protection of the citizen as a consumer—as a purchaser of new or used vehicles and as a purchaser of automotive parts and repairs.

Protection of New Vehicle Purchasers

Programs under the national Traffic and Motor Vehicle Safety Act of 1966 have already begun to afford significant protection to the new vehicle purchaser. As these programs are expanded and intensified, the scope and value of that protection will increase commensurately.

The purchaser of a vehicle manufactured after 1 January 1968 already has the assurance that whatever vehicle he chooses to buy meets minimum safety standards in a number of important areas. Thus, in comparing makes and models of new motor vehicles, the prospective purchaser no longer has to investigate whether or not a given model incorporates certain safety features or question the basic minimum safety performance of those aspects of vehicle performance covered by the new safety standards.

It must be emphasized that this does not mean that there will be no differences among vehicles when they are either new or used as to safety qualities or that a prospective purchaser is not wise to investigate the safety quality of competing makes, both in areas not covered by standards and for safety performance in excess of that required by the present standards. Rather, it only means that even the unquestioning consumer is ensured of at least minimum protection in areas covered by the standards. The development of new standards and the improvement of existing standards will progressively extend and upgrade this assurance.

However, it is clear that the consumer ought to have more information available about the safety performance of new vehicles than the simple assurance that all vehicles meet minimum safety standards. Section 112(d) of the National Traffic and Motor Vehicle Safety Act of 1966 1/ authorizing the Secretary of Transportation to require manufacturers to provide the consumer with performance data and other technical data related to performance and safety will be implemented to provide purchasers of vehicles with information on such aspects of performance as stopping distance under given vehicle and road conditions. The availability of such data in comparable form for all makes and models will make it possible for the first time for the consumer to evaluate meaningfully a number of aspects of the safety performance of competing vehicles. It is to be hoped that another consequence will be to encourage manufacturers to compete in safety performance above the minimal requirements of the standards, just as they now compete in power and style.

At present, Safety Standard 109 requires the labeling of tires with information important to the consumer, such as size designation, maximum permissible inflation pressure, maximum load rating, and other similar information. Safety Standard 110 requires that manufacturers permanently affix to the glove compartment door, or at an equally accessible location, a placard informing the consumer of the vehicle capacity weight, seating capacity, and recommended tire size designation and tire inflation pressure for maximum loaded vehicle weight and, subject to certain limitations, for any other manufacturer-specified vehicle loading condition.

Another source of relevant information for the prospective new vehicle purchaser is the listing of owner notifications of defect notification and recall

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1/ P.L. 89-563.

campaigns by manufacturers under Section 113 of the National Traffic and Motor Vehicle Safety Act of 1966. Since enactment of the law in September 1966, over 200 campaigns have been conducted resulting in the recall of about 5 million vehicles. The publicity given such campaigns provides the consumer with a means for judging the design quality and construction quality for a given make or model.

The programs described in this report will also make available much more information to the prospective new vehicle purchaser regarding the safety qualities of each vehicle. For example, under the Department of Transportation standard, the data to be derived from State motor vehicle inspections, including data on defects, will be broken down by make and model and published. The accident record information collected by States under the Department of Transportation standard will also be available to the public, in a manner which, of course, will not identify individuals.

Taken together, these programs and sources of information will enable the purchaser of either a new or used vehicle to make an enlightened choice with respect to the safety qualities of competing vehicles.

Protection of Used Vehicle Purchasers

Compared to the purchaser of a new vehicle, the purchaser of a used vehicle has less safety protection under any existing program and scant information available for decision-making. To some extent the new vehicle safety standards will ultimately offer the used motor vehicle purchaser some degree of protection. For example, the future purchaser of a used 1968-model motor vehicle will be acquiring one equipped with an energy-absorbing steering column and other safety features and one that will have met certain performance requirements, at least as of the time of its manufacture. Therefore, one potentially important protection available to the used motor vehicle purchaser is the extension and intensification of the new motor vehicle safety standards program. This will be particularly meaningful when, as is contemplated, the standards incorporate "durability" criteria.

Although the new motor vehicle standards will progressively offer a greater degree of protection to used motor vehicle purchasers in general, the purchaser of a specific used vehicle nonetheless ought also to have available some assurance that that vehicle is reasonably safe. There are a variety of techniques for providing this assurance.

Periodic Inspection

The implementation of a thorough periodic vehicle inspection program will provide a means for ensuring the used motor vehicle purchaser that a given vehicle performed at an acceptable level of safety quality at its last inspection. Although this affords somewhat greater assurance than that provided by the new motor vehicle standards alone (i.e., that the vehicle met certain safety criteria

as of the time of its manufacture), it nonetheless does not inform him of the current safety quality of the vehicle.

Presale Inspection

Requiring that used vehicles must be inspected immediately prior to their sale would impose a substantial additional burden on inspection facilities, since it is estimated that about 25 percent of American vehicles are resold annually; 1/ however, it would result in the inspection of a large number of used vehicles very rapidly.

However structured, presale inspection would afford the used motor vehicle purchaser some degree of assurance that his vehicle is in acceptably safe condition at the time of sale.

Vehicle History Information

A major unknown factor facing the buyer of a used motor vehicle is lack of knowledge about its history of maintenance, accidents, or defects. This information gap could be remedied in part by making available to the prospective purchaser of a specific used motor vehicle such information as:

a. Whether the vehicle had been involved in an accident or reported as stolen; this information would be recorded in the State traffic records pursuant to standards issued under the Highway Safety Act of 1966.

b. The vehicle's record at its periodic inspections.

c. Information on notification under Section 113 of the National Traffic and Motor Vehicle Safety Act of 1966 of the vehicle's inclusion in any defect recall campaign.

d. The nature of any claims made under the vehicle warranty.

These and other related data could be provided to the prospective buyer in several different ways. One alternative would be to require a permanent record of this information inserted by the appropriate governmental unit or repair facility on a log attached to the vehicle.

1/ Estimate by the Research Department, National Automobile Dealers Association, Washington, D.C. According to a July 1967 survey by the Bureau of the Census, about 50 percent of all cars owned are used when purchased.

Another possible alternative would be to require such data to be reported to the State and kept electronically stored on a system compatible with the systems to be established in the Department of Transportation, National Highway Safety Bureau, which is setting up a vehicle information register to gather data needed for setting motor vehicle safety standards. 1/ With such data centrally available for retrieval it would be possible, although the cost and feasibility is yet to be determined, for a prospective purchaser of a used vehicle to obtain a summary of the vehicle maintenance history.

Although such alternatives would doubtless be complex in operation, nonetheless they offer considerable promise for casting light on the unknown features of a used motor vehicle's past. Studies have already been initiated regarding the types of information that should be included in such a program of consumer assistance and the management and data processing techniques it would require.

Protection of Purchasers of Automotive Repairs

Nature of the Problem

In many ways the current plight of the used motor vehicle purchaser is far less difficult than that of the purchaser of automotive repairs. The purchaser of repairs often does not know precisely what repairs he wishes—or needs—but rather must rely on the diagnostic skills of the mechanic who seeks to sell him the repairs. As President Johnson said in his recent Consumer Message to Congress: "Repair work is sometimes excellent, sometimes shoddy, and always a gamble." 2/

The fact that motor vehicles degrade with time and use is well known to most drivers, even if they do not understand the reasons. Cumulative degradation of critical components can be traced to a number of causes. When excessive degradation stems from design or manufacturing deficiencies, it will occur in spite of careful use and maintenance by the owner and can only be prevented by increased emphasis by the manufacturer on product quality and reliability.

However, some degradation is the result of abuse, inadequate and improperly performed maintenance, and poor quality repair parts. The vehicle owner has a legal and moral responsibility to ensure that the public is not subjected to the risk of injury arising out of the operation of a vehicle that is

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1/ Similar to and to be made a part of the National Driver Register (provided in Title IV of the National Traffic and Motor Vehicle Safety Act of 1966) under the National Traffic Accident and Injury Analysis Center.

2/ U.S. House of Representatives, 90th Congress, 2d Session, Document No. 248, 6 February 1968.

rendered unsafe because of degradation within his control. Because of the technically complex nature of the motor vehicle, the owner needs substantial assistance from the automotive repair industry in meeting his responsibility for keeping his vehicle in a safe condition.

As the Consumers Advisory Council's 1966 Report to the President stated:

> "Unless the consumer is a mechanic or mechanically inclined he can neither diagnose his car's ills nor judge the proficiency of repairs and whether the repair price was reasonable." 1/

Truth in the Quality of Repair

Unlike most service industries whose work affects the safety of the public, the automotive repair industry lacks uniform or widely accepted standards for the quality of its work. The result has been not only mass inconvenience for the consumer, but severe variation in the reliability of repaired vehicles.

The mechanic's skill is an important safety factor even in relatively minor jobs; the improper fastening of wheel lugs, for example, has allowed wheels to roll off moving vehicles, sometimes with tragic results.

Moreover, evidence is mounting that many vehicle owners are being victimized by poor or unnecessary automotive repair work and excessive charges. For example:

a. A New York study of 19 automobile repair garages showed that only five accurately diagnosed a minor engine defect for which the repair cost ranged from no charge to $40, and 11 garages—60 percent of those surveyed—turned in completely false diagnoses. 2/

b. In a similar study in the Washington, D.C. area, a Washington Post reporter visited 16 State authorized private inspection garages and found:

> "...Repair estimates ranged from zero at five garages, where the auto was approved without repairs, to $77.50 as the cost for meeting the required safety standards.

1/ Consumer Advisory Panel, Consumer Issues 1966, A Report to the President, 12 June 1966, p. 72.

2/ Congressional Record, p. 13734-13735, 19 October 1967.

"Nine garages rejected the car because of improperly adjusted headlights. The headlights were adjusted at five garages at costs ranging from $2.50 to $3.50. But after each adjustment, subsequent garages ruled the headlights out of focus.

"Repairs 'needed' to pass inspection included front-end alignment at three garages, backup lights not working at three more, and defects in the steering mechanism—idler arm, ball joints and shock absorbers—at two other garages." 1/

The latter two examples pertain to a practice known under a variety of names, possibly the most common being "scalping"; that is, the unnecessary repair or replacement of parts, resulting in wasteful expenditures on the part of the vehicle owner.

These examples suggest a need for nationwide minimum standards which will ensure adequate repair quality. These could include standards for licensing repair facilities, mechanics, or both. National training programs for mechanics to upgrade existing skills and to supplement an inadequate labor supply are a pressing need. The motor vehicle manufacturers commonly train only mechanics employed or to be employed by franchised dealers, but these dealers perform only about one-third of all automobile repairs. Independent garages perform about 20 percent. Recently the Independent Garage Owners of America, Inc., announced adoption of a voluntary motor vehicle repair warranty plan. More than 4000 member garages will participate and give warranty certificates for repair work.

A number of bills recently have been introduced in the Congress concerned with protecting the consumer against misrepresented or fraudulent repair work, the licensing of mechanics, and the adequancy of warranties. In addition, New York State recently endorsed legislation for licensing repair shops. It is estimated that there are about 50,000 such shops in the state.

If the entire used vehicle safety effort is to be centered on the repair of safety-deficient vehicles, surely the consumer is entitled to some assurances that the repairs he is required to pay for are being performed in a reliable garage by adequately skilled personnel.

1/ Bart Barnes, "Maryland Inspectors See Same Car Differently," The Washington Post, 17 April 1967.

Parts

Closely allied to the problem of the quality of repair work is the safety adequacy of parts and supplies used in automotive repairs. Original equipment replacement items are available only from vehicle manufacturers through their own dealers and at prices substantially above those of competitive parts. This situation has encouraged the expansion of the new, "nonstandard" replacement parts business, the parts rebuilding business, and the salvage parts (junkyard) business to the point where these sources supply a major percentage of all parts and supplies sold. Although some such parts are of acceptable quality, many are not. The safety implications of the use of a subquality part, such as a brake lining, are apparent. Some controls currently exist at the Federal level and some within individual States; however, the present protection afforded is far from adequate.

As in the case of mechanics' skills, nationwide minimum standards regarding the quality of replacement parts and supplies related to safety are a necessary adjunct to the program for used motor vehicle safety, and, under the authority of the National Traffic and Motor Vehicle Safety Act, the development of such standards will be given careful consideration.

Economic Aspects

Central to the used vehicle safety effort is the difficult question of how and when the greatest reduction in risk can be achieved within the economic capacities of the population groups who must bear the costs.

The usual sequence is that as motor vehicles get older, repair costs go up while safety qualities deteriorate. But characteristically, older motor vehicles successively filter to economic groups less able to pay repair costs. This is a major problem for the heads of low-income households, but applies also to teenagers or young persons from even moderate income families, and may well account in part for their high crash rates.

The Bureau of the Census estimates that 57 percent of the households with earnings of less than $5,000 a year own cars, 1/ but the latest model owned by about two-thirds of these households were cars 5 years old or older. See Illustrations 6.1, 6.2, and 6.3. In comparison over 90 percent of the households with annual earnings of $5,000 to $7,500 own cars, and less than half of the cars owned are 5 years old or older.

In a study of poverty in Los Angeles, 2/ about 55 percent of the unemployed males and 65 percent of the employed males said they owned a car. For the unemployed, the percent owning cars of various ages were:

1/ See Appendix G.

2/ Hard-Core Unemployed and Poverty in Los Angeles, prepared by the Staff of the Institute of Industrial Relations at the University of California, Los Angeles, under a contract with the Area Development Administration, U.S. Department of Commerce, completed in December 1964.

Age of Car	Percent of Unemployed Owning the cars
New to 4 years old	15.5 percent
5 to 9 years old	38.5 percent
10 to 14 years old	34.5 percent
15 years old and older	11.5 percent

The ages of cars owned by the employed were somewhat younger:

Age of Car	Percent of Employed Owning the cars
New to 4 years old	16.5 percent
5 to 9 years old	52.7 percent
10 to 14 years old	26.4 percent
15 years old and older	4.1 percent

The costs of maintaining vehicle safety quality and paying for necessary repairs clearly can, and undoubtedly does, pose a serious problem to lower income groups. In the absence of adequate public transportation, they often have no alternative for getting from home to work except in older vehicles, many of which would probably require repairs costing in excess of the value of the vehicle to pass even a minimal standard of motor vehicle inspection. The economic issues, however, extend to all classes of consumers—the owners of the 94 million vehicles in use today—because all owners will bear direct cost burdens as a result of the maintenance and repair requirements implicit in any used vehicle safety standards and associated inspection standards.

Programs whose success depends in large part on striking the proper balance between cost and risk cannot afford to allow both factors to be distorted by the provision of inadequate (or unnecessary) services at inflated prices. Not only are standards required for mechanic skills and replacement parts, but techniques must be devised to ensure that repair services are performed at a fair price. Some of these techniques may be as uncontroversial as the promotion of sophisticated technology to lower repair costs; others might involve a variety of other approaches. Some of these approaches are doubtless within the proper jurisdiction of State regulation; others would depend on Federal action. This entire area will be considered by the Department of Transportation as resources permit.

ILLUSTRATION 6.1

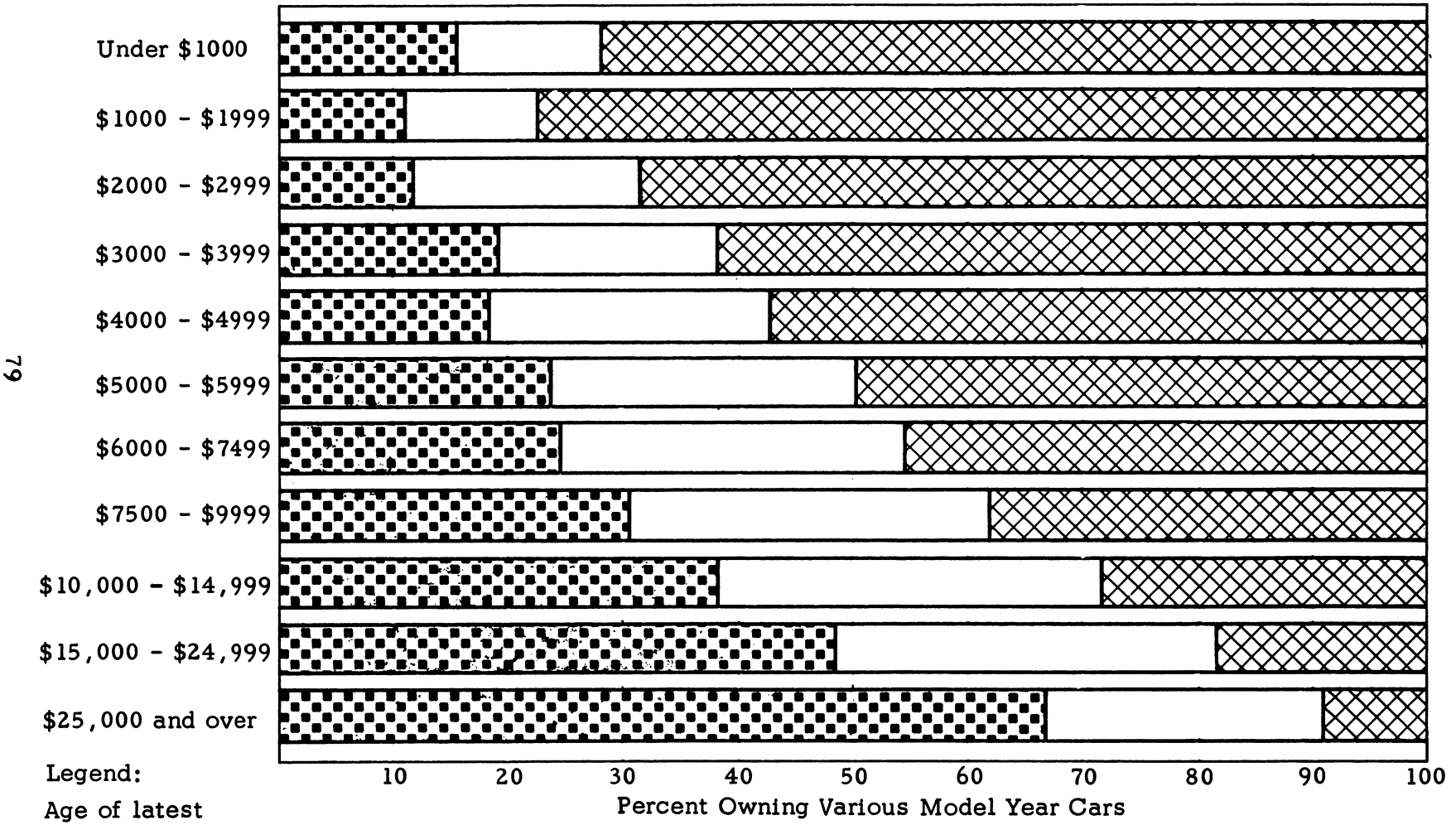
U. S. HOUSEHOLDS OWNING CARS: PERCENT DISTRIBUTION BY INCOME OF HOUSEHOLD AND AGE OF CAR, JULY 1967

Source: U. S. Department of Commerce, Bureau of the Census, July 1967 Survey

Income Group	Households Owning Cars			
	Total	Year of Latest Model Owned		
		1966-67	1964-65	1963 or earlier
Under $1000	2.0	0.3	0.2	1.4
$1000 - $1999	4.5	0.5	0.6	3.4
$2000 - $2999	6.7	0.8	1.3	4.5
$3000 - $3999	7.7	1.5	1.5	4.6
$4000 - $4999	8.2	1.5	2.0	4.7
Total under $5000	29.1	4.6	5.6	18.6
$5000 - $5999	10.4	2.5	2.8	5.1
$6000 - $7499	14.7	3.6	4.4	6.6
$7500 - $10,000	16.9	5.2	5.3	6.4
$10,000 - $14,999	17.0	6.5	5.6	4.8
$15,000 - $24,999	5.7	2.8	1.9	1.1
$25,000 and over	1.5	1.0	0.4	0.1
N.A.	4.8	1.4	1.3	2.0
Total	100%	27.6	27.3	44.7

ILLUSTRATION 6.2

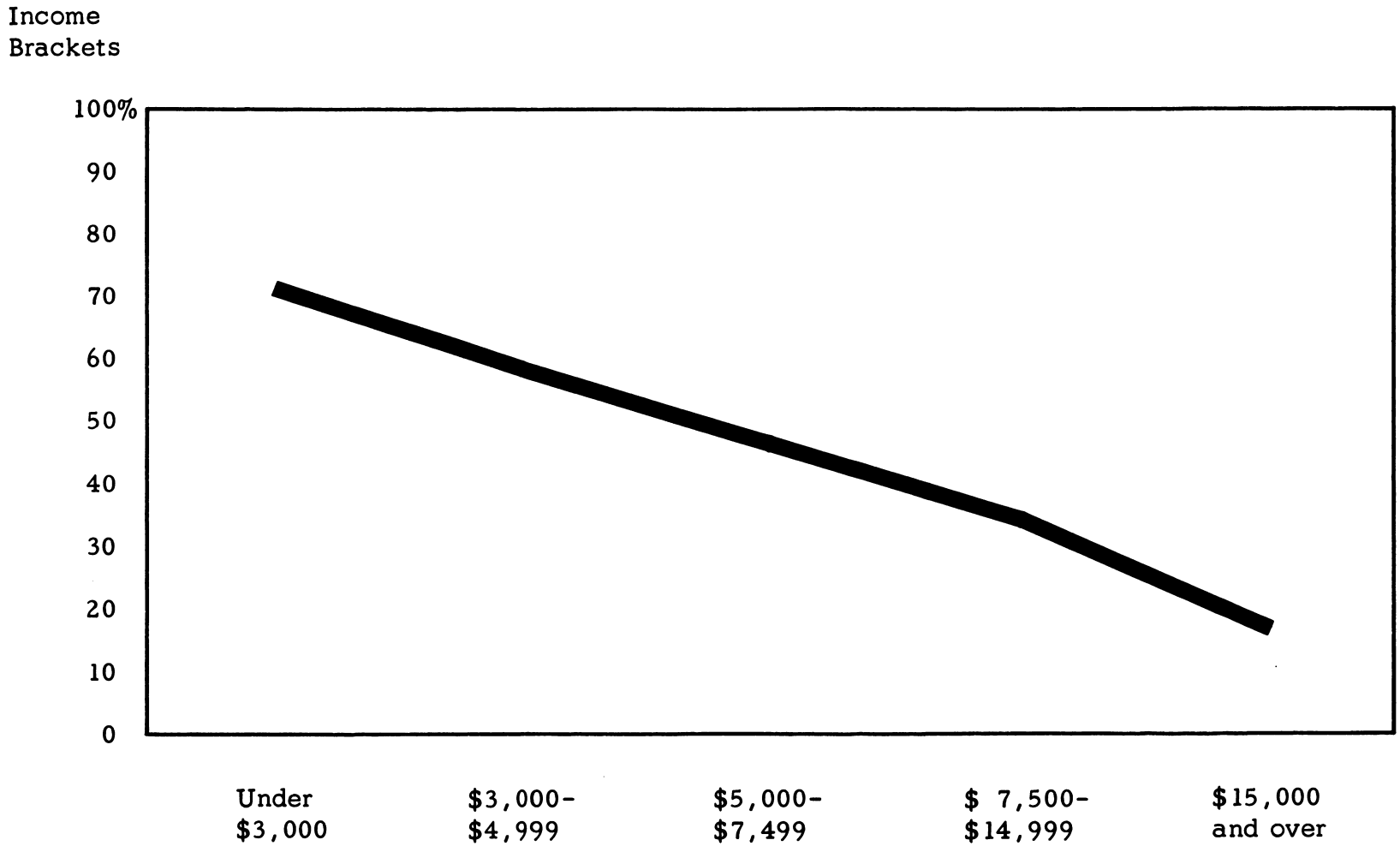
PERCENT DISTRIBUTION OF AGE OF CARS WITHIN
U.S. HOUSEHOLD INCOME GROUPS, JULY 1967*



*SOURCE: U. S. Department of Commerce, Bureau of the Census, July 1967 Survey.

ILLUSTRATION 6.3

PERCENT OF CAR-OWNING HOUSEHOLDS IN SELECTED INCOME BRACKETS WHOSE LATEST MODEL CAR IS 5 YEARS OLD OR OLDER



Source: Department of Commerce, Bureau of Census, July 1967 Survey

VII. ANALYSIS AND RESEARCH

The highway safety field has always been severly handicapped by a dearth of scientifically sound and objective data for program development. The need for augmenting the existing fund of knowledge has long been unmistakably clear. Presently, many programs must be justified on little more than reasonable, but essentially subjective, judgment, and this is directly traceable to the fact that highway safety has not received, until recently, anything approaching proper levels of research attention.

This lack of fundamental knowledge cuts across the board in all motor vehicle and highway safety areas, but its effect becomes particularly apparent when the Government comes to grips with the realities of the standards setting and later compliance checking processes. There is a paucity of objective performance data for setting and enforcing new motor vehicle safety standards, used motor vehicle safety standards, and State and community highway safety program standards.

There is unanimity of opinion on the importance and urgency of research in motor vehicle and highway safety. The President and the Congress have stated that one of the primary purposes of the 1966 legislation was to provide direction and funding for this activity.

> "We can no longer tolerate ineffective safety programs that result from the complete lack of basic research into the real cause of accidents." 1/

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> "The Federal Government must develop a major independent technical capacity sufficient to perform comprehensive basic research on accident and injury prevention, adequate

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1/ "Remarks by President Johnson on National Transportation Week," The New York Times, 23 April 1966.

to test and contribute to the quality of the industry's safety performance; a technical capacity capable of initiating innovation in safety design and engineering and of serving as a yardstick against which the performance of private industry can be measured; and, finally, a technical capacity capable of developing and implementing meaningful standards for automotive safety."1/

* * * *

"Standards, of course, cannot be set in a vacuum. They must be based on reliable information and research. One of the facts which was brought to the fore in the course of the committee's hearings was that it is virtually impossible to obtain specific information and data concerning the causes of traffic accidents and the performance of vehicles in accident situations. Much work in this area is being done but it is difussed. Under this bill this work can be augmented and channeled so that it will be more widely disseminated to all interested persons thus leading to improved motor vehicle safety performance with a consequent reduction in deaths and injuries."2/

The Department of Transportation has initiated a broad-gauged research activity under both the National Traffic and Motor Vehicle Safety Act and the Highway Safety Act. Participating in this program are a number of diverse contractors, including universities, foundations and other nonprofit groups, and industrial consultants. The goal is to provide new fundamental understanding in motor vehicle and highway safety that directly relates to establishing and implementing meaningful and practicable performance standards.

Research on the Safety of Vehicles in Use

Research on the safety of vehicles in use has to be approached from two directions. First, detailed laboratory and field studies of the actual physical processes underlying the deterioration of vehicle components with

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1/ U.S. Senate, 89th Congress, 2d Session, Committee on Commerce, Report No. 1301, 23 June 1966, p. 4.

2/ U.S. House of Representatives, 89th Congress, 2d Session, Committee on Interstate and Foreign Commerce, Report No. 1776, 28 July 1966, p. 11.

use are required to establish the sensitivity of the vehicle design to such deterioration. Second, the level of deterioration present in vehicles involved in crashes, and the extent to which this deterioration contributes to causation of the crashes must be identified. This crash information will provide substantial validation of the laboratory and experimental work on component deterioration with use, and, more generally, for the ultimate validation of the vehicle design and construction.

Substantial research was initiated along with the study 1/ which provides the foundation for this report. As this work evolved, major needs for fact finding and new avenues of research have been identified which will have to be explored as part of a comprehensive used vehicle safety program. These, grouped under five major headings, are:

A. Research on Vehicle Deterioration With Use.

B. The Significance to Safety of Vehicle Deterioration.

C. Inspection and Diagnosis of Vehicle Safety Quality Conditions.

D. Maintenance and Repair of Vehicles.

E. Implementing Used Vehicle Safety Programs.

A. RESEARCH ON VEHICLE DETERIORATION WITH USE

All vehicle components and parts deteriorate with use and hence in principle all can contribute to accident causation. In practice, however, a number of indications point to two primary problem areas: brakes, and steering and handling of the vehicle. Since the design and condition of tires relate to both braking and steering performance, they must be treated as a third major area of concern.

A number of projects have been initiated and are in the early stages with plans for expansion as the program evolves; others are planned for future programs. The following are examples of significant research needs, either in progress or projected.

1/ Operations Research Incorporated, An Investigation of Used Car Safety, FH-11-6522. The final report is not scheduled to be submitted to the Department of Transportation until June 30, 1968. It will be available in the Clearinghouse for Federal Scientific and Technical Information sometime after that date.

EXAMPLE 1: Identify the Effects of Wear and Deterioration Upon Braking System Performance.

The importance to safety of adequate braking performance cannot be questioned. Ideally, one would want the level of braking performance to be always near what it was when the vehicle was new. Practically, however, progressive deterioration with time and use cannot be avoided.

The purpose of this program, therefore, is to identify the significant types and magnitudes of deterioration in brake system components, and the relative effects upon braking performance.

EXAMPLE 2: Identify the Relationships Between Wear and Steering System Malfunctions.

Along with braking, the importance to safety of adequate steering is indisputable. Again the problem is one of determining the maximum deterioration that should be permitted before corrective repairs or parts replacement are required.

The purpose of this program is to improve fundamental understanding of the effects of specific malfunctions in the steering system. An important end in mind is to be better able to delineate sound bases for inspecting vehicle steering for dangerous front end "wobble" and incipient failures.

EXAMPLE 3. Identify the Relationships Between Tire Wear and Safety.

A somewhat different problem with tires is that deterioration with wear, time in use, and exposure to the elements is an accepted fact. Although the increasing relevance to safety of successively lower amounts of tread appears to be self evident, there is limited technical evidence that supports any particular value as a point beyond which a tire should no longer be considred sufficiently safe.

The Department has accordingly undertaken a major program of tire research and testing under an agreement with the National Bureau of Standards, Department of Commerce.

EXAMPLE 4: Identify the Interdependencies Between Original Design and Used Vehicle Safety Qualities.

The standards to which new motor vehicles are built necessarily establish boundaries for used vehicle safety standards. In addition, experience gained with used vehicles can be quite useful in establishing new motor vehicle safety standards. In some cases, extremely restrictive tolerance limits for new vehicle safety standards may reduce the criticality or probability of a component failure so much that the issuance of a safety standard for used motor vehicles may not be necessary. Such shifts in the balance between new and used motor vehicle safety standards have broad economic and technical implications in terms of quality control and manufacturing processes of new motor vehicles and the inspection re-requirements for used motor vehicles.

The present Federal safety standards for "new vehicles" identify performance requirements at the time of manufacture. A major program need is to develop methods to correlate "showroom" performance requirements with performance reliability over extended periods of time.

B. THE SIGNIFICANCE TO SAFETY OF VEHICLE DETERIORATION

Research on the fundamental processes of wear and deterioration of such important vehicle component systems as brakes, steering, and tires will produce substantial insights into the significance to safety of various levels of deterioration. Such insights are invaluable for the development of appropriate used vehicle safety standards.

However, the most important single ingredient for justifying standards, and for corroborating standard values suggested by laboratory results, is detailed information on actual experience of vehicles driven on public thoroughfares, by all types of drivers, under all types of weather and road conditions. Several different studies provide this type of information.

EXAMPLE 5: Initiate a Nationwide Inventory of the Levels of Safety of Vehicles in Use and Establish a National Register of This Information.

Accurate assessments are needed of the percentage of all vehicles in use with one or more safety-related defects and their degree of deterioration. It would be especially useful if this were done in a manner enabling an analysis of how vehicle deterioration is associated with such factors as mileage, type of service, type of climate, and other conditions of use.

An initial inventory of this percentage is required immediately along with procedures for keeping it current. Such a continuing inventory of the safety quality of all vehicles in use is fundamental to the entire used motor vehicle safety effort for two primary purposes: first, as a means of comparing information obtained from crash investigations with the total population of vehicles in use, and second for observing the process of deterioration over the full life cycle of the vehicles.

EXAMPLE 6: Examine Alternatives for Inspecting Vehicles Involved in Crashes and Criteria for Allowing Their Return to Use on Public Thoroughfares.

Most vehicles will be inspected in the context of "normal" use and exposure. However, vehicles which have been exposed to abnormal stresses will require special attention.

A motor vehicle involved in an accident may be exposed to forces beyond the design limits of certain components. This severe exposure might cause later failures or otherwise accelerate degradation. If repairs are not made, or are not made properly, accident-induced component degradation can result in failure before the next scheduled inspection period or before the time for which normal wearout is predicted. Parts not normally inspected may also be unduly stressed during a collision. A workable means of collision damage assessment must be devised to meet the goal of keeping unsafe vehicles off the road.

The consequences of a vehicle crash vary from relatively minor crumpled fenders and damaged trim to major structural damage. Depending on the extent of impact forces and resulting damages to the vehicle, alternative policies and practices are needed for ensuring that before a vehicle which is involved in a crash is put back in use, it has been restored to a reasonably safe working order.

In order to arrive at the most appropriate inspection alternatives for accident-involved vehicles and to assess their economic and safety consequences, a broad program of vehicle crash damage assessment must be undertaken.

EXAMPLE 7: Initiate a Nationwide Investigation of the Causes and Frequencies of Vehicle Breakdowns and Other Roadside Emergencies and Stoppages.

There are strong indications that vehicles stopped at curbs or on the shoulder of a highway for emergency repairs, overheating, out of fuel, flat tires, and mechanical breakdowns of one form or another are involved in or cause an exceptionally large number of accidents.

The control of factors leading up to such roadside emergencies is thus of major importance for inspection and other used motor vehicle safety programs where new emphasis must be directed to the types of vehicle failures that produce the most frequent breakdowns.

EXAMPLE 8: Initiate a Nationwide Program of Medical Engineering Investigation of Crashes.

The goal of this major program is to improve understanding of the relationship between vehicle performance and injury pathologies in traffic crashes. It centers on the development of systematic medical engineering techniques and procedures for the study of traffic injuries and fatalities in relation to vehicle design features, state of repair, the highway, and other relevant factors.

The first phase of this program is now nearing completion with an experienced interdisciplinary team from one university having indoctrinated medical-engineering teams from five other universities in common methodology and protocols for on-scene investigation of vehicle crashes and detailed clinical follow-up on the resulting injuries. The second phase will involve the newly trained teams in beginning to carry out crash investigations in their respective regions throughout the country in accordance with the defined protocols.

EXAMPLE 9. Develop Improved Methods for Conducting Accident Investigations.

The objectives of this study are to evaluate existing experimental techniques and test equipment for investigating traffic crashes. Included will be the development of improved means for the collection and analysis of data and the development of

investigation techniques to reduce subjectivity, improve information reliability and content, and decrease the time needed for "on-the-scene" investigation.

An important part of this study is the documentation of operational procedures used in crash investigations by State and local communities. After appropriate evaluation of their effectiveness, they are to be incorporated into operational procedural guidelines that will facilitate investigation uniformity throughout the nation. Also to be translated into these guidelines are any new techniques developed in the program of medical engineering research investigation of accidents.

C. INSPECTION AND DIAGNOSIS OF VEHICLE SAFETY QUALITY

A number of different types of research activities are directed toward the development of improved inspection criteria and procedures for assessing compliance with used vehicle safety standards.

EXAMPLE 10. Provide Specifications and Procedures for State Inspection Programs and Correlate Them With Federal Used Motor Vehicle Safety Standards.

The usefulness of inspection data collected in each State is directly related to the consistency of the procedures used in performing the inspection. Unavoidable differences in human and equipment performance can produce considerable variation in the measurement process. It is therefore important to examine the extent to which guidelines and procedural manuals can favorably influence consistency in the interpretation of motor vehicle safety standards and the performance of inspection.

Once the levels of safety quality that reasonably can be expected of vehicles in use are identified in the form of Safety Standards, it is then necessary to translate them into meaningful inspection criteria. This is essential if the vehicle inspection is to detect accurately whether a vehicle meets the requisite levels of safety.

EXAMPLE 11. Investigate the Feasibility of Automated Diagnostic Equipment for Motor Vehicle Inspection.

In addition to properly trained personnel, proper equipment and facilities are needed for successful motor vehicle inspection.

Better equipment undoubtedly will produce better inspections with fewer "over-inspection" errors (requiring unnecessary repairs) as well as fewer "under-inspection" errors (permitting dangerous cars to pass inspection).

The potential of automated diagnostics and other improvements in inspection equipment is very great, and development of this technology should be accelerated. An accompanying area of investigation involves the investment consequences to the consumer, the States and the Federal Government resulting from different concentrations of motor vehicle inspection manpower and equipment.

There is, however, a cost-benefit trade-off between operating a program with manual inspection procedures and operating it with increasingly sophisticated and costly automated diagnostic equipment. It therefore becomes necessary to develop a detailed understanding of the technological state-of-the-art of automated diagnostic and testing procedures for possible use in mass vehicle inspections programs, the near-term possibilities of new procedures, and the economic implications of present and near-term technologies.

EXAMPLE 12: Develop Policies and Procedures Regarding Inspection of Motorcycles, Trucks, Buses, House Trailers and Utility Vehicles.

These vehicles present a number of unique inspection requirements because their design, construction, maintenance requirements, and operating features substantially differ from those of passenger automobiles. For example, heavy duty truck-trailer combinations require different types of inspections and inspection facilities. These inspection requirements must be explored in specialized studies.

D. MAINTENANCE AND REPAIR OF VEHICLES

The effectiveness of the used motor vehicle safety program depends upon the availability and quality of automotive repairs and maintenance services, which, in turn, concerns the automotive repair labor force, the replacement parts industry, and repair technology. A number of different types of studies concerned with repair and maintenance technology are relevant to the improvement of used motor vehicle safety.

EXAMPLE 13: Initiate a Nationwide Inventory of Vehicle Repair Practices and an Analysis of Consumer-Owner Habits in Maintaining Their Vehicles.

This activity would be directed to documenting and analyzing systematically the relevant data associated with repairs conducted by independent garages, service stations, and new car dealers under dealer warranties.

A parallel activity would document the habits of vehicle owners in maintaining the safety of their own vehicles, and would delineate the most appropriate and effective role of the owner in the maintenance of vehicle safety.

Both activities would be directed to individual vehicle owners as well as to operators of large fleets.

EXAMPLE 14: Initiate an Inventory of the Skill Levels and Requirements of Automotive Maintenance and Repairs Manpower.

The effectiveness of used vehicle safety programs and, in particular, their impact upon consumer-owners will depend substantially upon the skill levels of automotive maintenance and repair personnel throughout the country. A comprehensive inventory is required of this manpower as the foundation for planning programs for providing adequate numbers of trained repair personnel.

An important corollary effort would identify the skill levels needed to perform repairs on safety-related features of vehicles. An inventory would have the greatest value if it identified the available manpower in categories of skill levels.

The delineation of needed skill levels in automotive mechanics who work on safety-related features of vehicles also has major implications for any proposal for licensing of mechanics. A number of opinions on such prospects have frequently been published. In the absence of substantive data regarding both what the required skills should be, and how many mechanics now have these skills, proper evaluations of the proposals and opinions are not possible.

E. IMPLEMENTING USED VEHICLE SAFETY PROGRAMS

The research programs already described will provide the foundation for the development of used vehicle safety programs. Work is also needed in the specifics of the procedures for program implementation by the States.

EXAMPLE 15: Develop and Evaluate Alternative Practices for Planning and Managing State Motor Vehicle Inspection Programs.

The immediate requirement is to continue to provide guidance to States in utilizing their own and Federal resources in developing effective and efficient motor vehicle inspection programs. A particularly urgent goal is to develop methods that will enable a State to design a motor vehicle inspection system which meets its own needs within the framework of meeting national objectives. Among the major issues of planning motor vehicle inspection systems are: manpower and equipment for motor vehicle inspection facilities; inspection station ownership and management; possible legal liability of the State for errors of inspection resulting either in accidents or in unwarranted repair costs; location policy for inspection facilities based on cost to the public and to the Government; feasibility and desirability of separating facilities by class of vehicle, make of vehicle, vehicle age, or similar criteria; effectiveness of random motor vehicle inspection along State highways in comparison with fixed installations; and impact on motor vehicle inspection of permitting repair mechanics to inspect and certify repairs.

EXAMPLE 16: Initiate an Inventory of Manpower, Equipment and Other Resources Needed for Motor Vehicle Inspection Programs.

State motor vehicle inspection programs comprise the foundation for the nationwide used vehicle safety effort. With a major expansion of this effort called for and urgently needed, the resources required to implement appropriately expanded State motor vehicle inspection programs must be examined.

With regard to the manpower requirement, it is quite likely that the demand for qualified personnel will far exceed the supply. This will limit the speed and thoroughness with which expanded motor vehicle inspection programs can be placed in operation.

The expanded inspection work load will require much greater utilization of semiautomated and fully automated inspection equipment. Notwithstanding the economics of using such equipment, the initial capital investment is substantial and poses a problem.

A complete inventory is required of the available resources for periodic motor vehicle inspection programs coupled with the problems of assisting the States in their utilization. A parallel program must identify the resource demands that cannot be met with the available supply, along with alternatives for making up the deficiencies.

A major aspect of this program is to examine various alternatives for providing the necessary inspection equipment ranging from the most basic manual methods up to the highly sophisticated automated systems that are coming into use so rapidly. In particular, the cost-benefit relationship in moving from adequate manual or semiautomated equipment to the fully automated techniques are to be studied.

Priorities in Used Vehicle Safety Research

These examples of the research required for an effective program to upgrade the safety quality of vehicles in use include both fact-finding studies and long-range research. Some of the work already has been started under Department of Transportation sponsorship, but much is still in the early planning stages. Priorities for each area of research will depend not only on budgetary restrictions and staff and other program limitations, but also on the interrelationships which will develop as various tasks are accomplished.

In some cases, the work inherently is long range in nature, such as that dealing with determining vehicle safety deterioration with time and use and relating performance and degradations to the original design. Similarly long range is the work that seeks to determine the significance to safety of vehicle deterioration. In other cases, results are immediately attainable; much of the fact-finding is in this category.

Examples of the latter are the particularly important crash investigation activities directed toward the early establishment of used vehicle safety standards. This type of fact-finding is basic to the entire program, and accordingly has very high priority. The mechanism for carrying it out, while initially spearheaded by Federally supported research teams, must eventually become part of the ongoing safety programs of States and communities.

The work on inspection and diagnosis of vehicle safety quality presents a somewhat different problem. States are already implementing expanded periodic motor vehicle inspection programs to meet the provisions of the Federal standard issued in June 1967. The operational aspects of the program cannot await the research results that undoubtedly will demonstrate how to improve the efficiency and effectiveness of operations. But the research must nevertheless be started now to begin to lay the groundwork for the needed long-term improvements.

The issues involving a program concerned with automotive repairs are inherently complex, with the problems compounded by their immediate relevence to consumer interests and the associated high degree of public visibility. Charges are frequent and widespread of inadequate repairs and exhorbitant over charging for repairs. The skill levels and supply of adequate repair manpower are widely reported to be seriously deficient. Priorities with regard to automotive repairs research clearly are directly related to used vehicle safety, but they have substantial overtones as well of major national importance relating to the entire field of consumer protection.

The fifth broad category of research dealing with improved methods for the implementation of used vehicle safety programs has high priority implications for some of the reasons already mentioned in the context of motor vehicle inspection. Specifically, States are moving ahead rapidly, and must make program decisions even before final research results are available.

The used vehicle safety research program comprised of these five groupings is long overdue. Results are needed today of studies that should have been started more than 40 years ago. Not only might thousands of lives have been saved, but a basic foundation of factual information that a proper research program would have produced by now largely does not exist. Braking performance provides a case in point.

The importance of braking reliability is generally agreed upon. The disastrous consequences of having brakes fail completely are self-evident. In between these extremes is some point where braking performance changes from adequate to dangerous, but as well as can be determined, there are no substantial data anywhere to guide this selection. Little is known, for example, about the condition of brakes in vehicles involved in crashes, and in the absence of such data, major uncertainties are unavoidable in isolating where the point of transition from adequate to dangerous braking occurs.

The braking example characterizes the principal handicap throughout the entire used vehicle safety program—the absence of specific factual information. For this reason, top priority during the start-up phases of the comprehensive used vehicle safety research program is assigned to fact-finding studies. Although these studies will have to continue over extended

periods, the initial sampling results will nonetheless provide at least some early guidance to the decision-making and program implementation by the States. The early results will, as well, feed directly into the other aspects of the research program.

The largest part of the work load in the development of a firm foundation of objective data on used vehicle safety performance will have to be assumed by the States through their periodic motor vehicle inspections, accident investigations, and other safety programs being implemented at State and local levels under the provisions of the Highway Safety Act. The role of the Federal Government is to ensure that all data are collected in a uniform manner under consistent conditions, so that what most likely would otherwise be fragmentary indications can be properly combined to identify a total national picture.

The need for a true Federal partnership with the States never was more clear, nor the promise greater of substantial progress in vehicle and highway safety.

VIII. NATIONAL PERSPECTIVES

To reduce motor vehicle accident losses, even as pressures increase for efficient and low-cost vehicular travel, a coordinated national effort is being mounted at Federal, State, and local levels, in the automotive industries, and in other parts of the private sector. Under the provisions of the National Traffic and Motor Vehicle Safety Act and the Highway Safety Act, this long-needed effort is composed of four Department of Transportation programs to:

a. Improve the safety qualities in the intrinsic design and manufacture of new motor vehicles and motor vehicle equipment

b. Ensure that vehicles in use on public thoroughfares are of adequate safety quality

c. Assist State and local governments in expanding and improving their highway safety programs with the assistance of Federal grants-in-aid

d. Improve the process of accident investigation, vehicle failure and injury assessment, and information analysis to provide the fundamental information for countermeasure allocation and evaluation.

All four groups of activities are interdependent. The basic performance and maintainability of motor vehicles in use depend on the initial design; the compliance program for both new and used motor vehicle performance standards must center on State motor vehicle inspection and related State programs; and without adequate information on accidents—the very core of the problem—it becomes difficult, if not impossible, to evaluate fully the effectiveness of any of these programs.

Since it is clear that the emerging program needs will substantially exceed available resources, patterns of resource allocation must be established among these countermeasure programs in spite of their strong interdependence. However, the present state of knowledge falls far short of yielding the type of information necessary for an assessment of maximum countermeasure payoffs, or of optimal patterns for the national investment that will be required to bring the problem of highway deaths and injuries under control. All program elements share the common goal of reducing traffic deaths and injuries, but almost no valid statistical data are available now to assess the relative value of one element over another. When reductions in traffic deaths and injuries do occur, the proportion of credit that can be ascribed to one program element cannot usually be isolated from that due to any other operating program element. When traffic deaths increase, the deficient countermeasure areas cannot usually now be delineated.

Apart from the dearth of information on the comparative values of various programs for improving the safety quality of motor vehicles in use, there remain many unanswered questions on the potential effects that these programs might have on different sectors of the economy. A few sample questions are:

For Vehicle Owners, will used motor vehicle safety standards

- Encourage a longer use of the vehicle before replacement because of improved maintenance, cause earlier replacement because of increased maintenance costs, or have no effect on replacement practice?

- Encourage more people to buy used, rather than new vehicles, because of improved and possibly documented maintenance?

- Promote or discourage attention to preventive maintenance?

- Decrease depreciation costs by increasing the market value of vehicles at replacement time?

- Decrease insurance costs by improving safety performance?

For State and Local Governments, will used motor vehicle safety standards

- Require the revision of laws and regulations pertaining to licensing, transfer of title, and registration?

- Create or extend requirements for interstate reciprocity agreements, for example in cases in which State motor vehicle inspection standards exceed the Federal standards?

For Auto Manufacturers, will used motor vehicle safety standards

- Increase, decrease, or not affect the sale of new vehicles?

- Force a shift in marketing strategy to compensate for a possible tendency of owners to keep vehicles for longer periods, e.g., place a greater emphasis on designed-in safety features available only on new vehicles?

- Encourage increased design emphasis on ease of maintenance and adjustment, e.g., headlight aiming?

- Increase the costs of engineering, manufacturing, and quality control in order to ensure that vehicles continue over the years to pass inspections as used motor vehicles?

- Require considerable revision of servicing, maintenance, and test procedures and instruction for existing as well as new models?

- Increase the need for specialized training for mechanics and inspectors, especially in the case of foreign manufacturers?

- Increase the demand for service and parts under manufacturer warranties?

For Automobile Dealers, will used motor vehicle safety standards

- Affect the relative number of sales between new and used vehicles?

- Increase the market value of used motor vehicles?

- Increase the demand for service on new vehicles sold? Used vehicles?

- Increase the amount of repair work required before a used motor vehicle can be resold?

- Increase the percentage of trade-ins scrapped?

- Increase the sales volume of replacement parts, retrofit kits, or modifications?

- Alter conventional trade-in allowances and practice?

For Parts Manufacturers, will used motor vehicle safety standards

- Increase the costs of engineering, manufacturing, and quality control?

- Increase the sales volume of replacement and retrofit parts?

- Render existing inventories of manufactured parts unmarketable?

- Stimulate proliferation of new products?

- Force changes in marketing strategy?

For Parts Retailers and Wholesalers, will used motor vehicle safety standards

- Increase the sales volume of replacement and retrofit parts?

- Increase inventory requirements?

- Reduce the variety of grades in quality and render existing inventories unmarketable?

For Repair Shops and Diagnostic Centers, will used motor vehicle safety standards

- Increase the demand for preventive and corrective maintenance and repair services and parts?

- Increase labor costs or cause a skill shortage if certification of mechanics is required?

- Increase diagnostic service as a preventive maintenance or as an inspection preparation measure?

- Increase the requirements for sophisticated diagnostic, repair, and inspection equipment?

- Increase parts and supplies inventory requirements?

For Customizing Shops, will used motor vehicle safety standards

- Force abandonment of certain commonly practiced modifications?

- Cause a shift in emphasis from modification for road use to modification for track use?

- Require special provisions for inspecting customized vehicles?

Research activities that will provide answers to questions such as these can neither be delayed nor accomplished overnight. But in the meantime, the countermeasures described in this report which carry substantial promise of saving lives must be promptly implemented. The challenge is to achieve balance between these immediate actions and the longer term research and other fact-finding activities that will produce better criteria for selecting among action alternatives.

In taking action, balance must be maintained between, on the one hand, placing what could be economically crippling demands on automobile and parts manufacturers, and on the other hand, allowing the continued production of vehicles that do not reflect the best in attainable safety design.

Other sensitive balances must be observed in Federal-State-local relationships in highway safety programs, particularly in the competition for State matching funds among the various Federal programs in housing, health, education, urban affairs, and others. Within the State and local highway programs, problems of balance arise in allocating resources as between, for example, motor vehicle inspection and driver education. Still other problems of balance exist in the trade-off between direct costs to the consumer and probable improvements in safety.

When the needed fact-finding activities, research, and actual operating experience in used motor vehicle safety programs begin to produce better information than is now available, it will be possible to identify with greater confidence the national priorities and associated resource allocations for improving used motor vehicle safety. However, even with our present levels of understanding, some basic national perspectives are clearly discernible.

- The upgrading of safety qualities of used motor vehicles will reduce traffic death and injury tolls.

- Few owners can recognize significant safety deteriorations in their vehicles or judge either the adequacy of repairs or the reasonableness of repair costs.

- Small unit costs arising out of Federal, State, or local program decisions to improve used motor vehicle safety could have major multiplier effects upon consumer expenditures. For example, with approximately 100 million vehicles in use, an additional average brake repair cost of $10 per year multiplies to a national figure of $1 billion.

- Notwithstanding the urgency of having dangerously old vehicles repaired or removed from public highways, the associated vehicle repairs or replacement costs could readily create a substantial economic hardship for many people, especially in lower-income groups.

Thus, although it is clear that there should be concerted Federal, State, and local efforts to upgrade safety qualities of vehicles in use, it is equally clear that substantial aggregate cost burdens on all consumers also can result, together with significant hardships for lower-income groups.

Another factor to consider is the program cost that will have to be met within some combination of Federal, State, and local budgets. A number of the cost elements recently have been estimated by the States on dollar needs for State and local highway safety programs. However, most of these estimates relate to implementing activities which are already proposed or in process. They will have to be reexamined with the introduction of new techniques and new program areas such as improvement in automotive repairs and increased mechanic skill levels. They also will have to be reexamined with regard to the costs of upgrading periodic motor vehicle inspection—the foundation of the entire used motor vehicle safety program. For example, the initial capital outlay alone to provide modern diagnostic equipment for motor vehicle inspection is estimated to be between a minimum of $600 million to about $800 million; additional inspection capital outlays to enlarge capacity to handle an increasing vehicle population will also be required. Alternatives for financing these heavy outlays for equipment must therefore be explored carefully.

Garages and repair shops will require additional equipment to compete in the provision of higher levels of repairs and maintenance services. Assistance under the legislative authority of the Small Business Administration will be investigated.

Problems of the magnitude of used vehicle safety are not solved cheaply. However, in evaluating the costs of the program which will be required to stem the tide of death and destruction on our roads, it should be remembered that the annual dollar cost to the nation of traffic accidents is in excess of $10 billion and, as the House Interstate and Foreign Commerce Committee added, "the cost in terms of grief and suffering is unmeasurable."1/

For the past half century we have chosen to pay that cost: 1.6 million Americans have died on the highways, more than in all the wars in our history. Under the landmark legislation of 1966, we now have the choice of paying the costs of safety instead of the costs of death and destruction. But inescapably, we will have to pay one or the other.

1/ U.S. House of Representatives, 89th Congress, 2d Session, Interstate and Foreign Commerce Committee, Report No. 1776, 28 July 1966, p. 10.

APPENDIX A

PASSENGER-MILES TRAVELED BY MODE IN THE UNITED STATES, 1966

	Millions of Passenger Miles		Percent
MOTOR VEHICLE		1,673,523	94.4
Personal passenger vehicles (including motorcycles)	1,578,654[1]		
Intercity motor buses (includes regulated and unregulated, charter, special, and regular routes)	24,592[2]		
Intracity motor buses	16,457[3]		
School buses	53,820[4]		
RAILROADS (CLASS I AND CLASS II)		17,162[5]	1.0
RAIL AND TROLLEY-INTRACITY		9,413	.5
Surface railroads	884[3]		
Rapid transit	7,920[3]		
Trolley	609[3]		
INLAND WATERWAYS (INCLUDING GREAT LAKES)		3,400[2]	.2
AIR		69,885	4.0
Public carriers	63,689[6]		
General (private)	6,196[7]		
TOTAL		1,773,383	

*Percentages do not add to 100 due to rounding.

PERCENT OF PASSENGER-MILES TRAVELED BY MODE IN THE UNITED STATES, 1966

Mode	Percent*
Motor vehicle	94.4
Railroads	1.0
Rail and trolley - intracity	.5
Inland waterways	.2
Air	4.0

* Percentages do not add to 100 due to rounding.

1. Department of Transportation, Federal Highway Administration, Bureau of Public Roads estimates, based on Highway Statistics, 1966, Table VM-1, p. 49, for mileage, and assumption of 2.1 persons per vehicle.

2. Interstate Commerce Commission, Transport Economics, November-December 1967 issue, p. 8.

3. American Transit Association estimates.

4. National Highway Safety Bureau estimates, based on reports of School Administrators and on National Safety Council data, for school year 1966-67.

5. Interstate Commerce Commission Releases, Part I for 1966.

6. Air Carrier Reports on Civil Aeronautics Board Form 41. Includes scheduled, nonscheduled, and supplemental (charter) flights.

7. Federal Aviation Administration.

APPENDIX B

LIST OF PENDING PROPOSALS AND ISSUED FEDERAL MOTOR VEHICLE SAFETY STANDARDS

Std. or Docket No.	Title/Description	Pass. Veh.	Multi-pur. Pass. Veh.	Trucks	Buses	Trailers	Motorcycles	Status	Effective Date	Comments
	PRE - CRASH: CONTROLS									
101	Control location and identification	X						RULE	1-1-68	
1-18	Control location and identification	X	X	X	X			ANPRM*		amends 101: adds vehicles and performance reqts
102	Transmission shift level sequence, starter interlock, and transmission braking effect	X	X	X	X			RULE	1-1-68	
	PRE - CRASH: DRIVER VISION—LIGHTING									
103	Windshield defrosting and defogging	X	X					RULE	1-1-68	
103	Windshield defrosting and defogging			X	X			RULE	1-1-69	
103	Windshield defrosting and defogging	X						RULE	1-1-69	adds performance reqts
1-13	Windshield defrosting and defogging		X	X	X			ANPRM		increases perf. requirements
104	Windshield wiping and washing system	X						RULE	1-1-68	68" wide and over
104	Windshield wiping and washing system	X	X	X	X			RULE	1-1-69	under 68" wide, adds vhcls
107	Reflecting surfaces	X	X	X	X			RULE	1-1-68	
108	Lamps, reflective devices and associated equipment		X	X	X	X		RULE	1-1-68	over 80" vehicle width
		X	X	X	X	X	X	RULE	1-1-69	under 80", adds other vhcls
112	Headlamp concealment devices	X	X	X	X		X	RULE	1-1-69	
111	Rearview mirrors	X	X					RULE	1-1-68	
1-14	Rearview mirrors	X	X					ANPRM		amends 111: increases perf. requirements
1-15	Rearview mirrors			X	X		X	ANPRM		amends 111: adds vehicles

*See Key on Page 112.

Std. or Docket No.	Title/Description	Pass. Veh.	Multi-pur. Pass. Veh.	Trucks	Buses	Trailers	Motorcycles	Status	Effective Date	Comments
	PRE-CRASH: BRAKES									
105	Hydraulic service brakes, emergency brake, and parking brake system	X						RULE	1-1-68	
1-1	Hydraulic service brake, emergency brake, and parking brake system	X						ANPRM		amends 105: increases performance req'ts
1-2	Hydraulic service brake, emergency brake, parking brake system		X	X	X	X		ANPRM		amends 105: adds vehicles
1-3	Braking systems						X	ANPRM		amends 105: adds motorcycles
106	Hydraulic brake hoses	X	X					RULE	1-1-68	
1-5	Brake hoses			X	X	X	X	ANPRM		amends 106: adds vehicles
1-4	Brake linings	X	X	X	X	X	X	ANPRM		new proposal
	PRE-CRASH: TIRES									
109	New pneumatic tires	X						RULE	1-1-68	
1-6	Tires		X	X	X	X	X	ANPRM		amends 109: adds vehicles
110	Tire selection and rims	X						RULE	4-1-68	
1-7	Tire traction	X	X	X	X	X	X	ANPRM		new proposal
1-8	Retreaded tires	X	X	X	X	X	X	ANPRM		new proposal

Std. or Docket No.	Title/Description	Pass. Veh.	Multi-pur. Pass. veh.	Trucks	Buses	Trailers	Motorcycles	Status	Effective Date	Comments
	PRE-CRASH: OTHER COMPONENTS									
1-9	Bumper height	X	X	X	X	X		ANPRM		new proposal
1-10	Bumper effectiveness	X	X	X	X	X		ANPRM		new proposal
1-11	Rear underride guard			X	X	X		ANPRM		new proposal
1-20	Trailer hitches	X	X					ANPRM		new proposal
113	Hood latches	X	X	X	X			RULE	1-1-69	
1-19	Maximum speed	X	X	X	X		X	ANPRM		new proposal
114	Theft protection	X						RULE	1-1-70	
1-22	Vehicle identification number	X						NPRM*		new proposal

*See Key on Page 112.

Std. or Docket No.	Title/Description	Pass. Veh.	Multi-pur. Pass. Veh.	Trucks	Buses	Trailers	Motorcycles	Status	Effective Date	Comments
	CRASH: IMPACT PROTECTION									
201	Occupant protection in interior impact	X						RULE	1-1-68	
2-1	Occupant protection in interior impact	X						ANPRM		amends 201: adds perf. reqt.
2-2	Impact protection for occupants from glove compartment doors	X						NPRM		new proposal
203	Impact protection for driver from steering system	X						RULE	1-1-68	
2-3	Impact protection for driver from steering system	X						ANPRM		amends 203: increases performance requirements
2-4	Impact protection for driver from steering system		X	X	X			ANPRM		amends 203: adds vehicles
204	Steering control rearward displacement	X						RULE	1-1-68	
2-17	Rider protection						X	ANPRM		new proposal

Std. or Docket No.	Title/Description	Pass. Veh.	Multi-pur. Pass. Veh.	Trucks	Buses	Trailers	Motorcycles	Status	Effective Date	Comments
	CRASH: OCCUPANT RESTRAINT									
202	Head restraints	X						RULE	1-1-69	
207	Anchorage of seats	X						RULE	1-1-68	
2-12	Anchorage of seats		X	X	X			ANPRM		amends 207: adds vehicles
208	Seat belt installations	X						RULE	1-1-68	
2-13	Seat belt installations		X	X	X			ANPRM		amends 208: adds vehicles
209	Seat belt assemblies	X	X	X	X			RULE	3-1-67	
2-15	Child restraint systems	X	X					ANPRM		new proposal
210	Seat belt assembly anchorages	X						RULE	1-1-68	
2-14	Seat belt assembly anchorages		X	X	X			ANPRM		amends 210: adds vehicles
2-11	Passenger seats				X			ANPRM		new proposal
	CRASH: GLAZING									
205	Glazing materials	X	X	X	X		X	RULE	1-1-68	
2-9	Glazing materials					X		ANPRM	1-1-69	amends 205: adds trailers
2-8	Windshield Mounting (Dislodgement)	X						NPRM	1-1-70	new proposal

Std. or Docket No.	Title/Description	Pass. Veh.	Multi-pur. Pass. Veh.	Trucks	Buses	Trailers	Motorcycles	Status	Effective Date	Comments
	CRASH: VEHICLE STRUCTURE									
2-5	Exterior protrusions	X	X	X	X	X	X	NPRM		new proposal
2-6	Intrusion	X	X	X	X			ANPRM		new proposal
2-7	Energy absorption	X	X	X	X			ANPRM		new proposal
	CRASH: COMPONENTS									
206	Door latches and door hinge systems	X						RULE	1-1-68	
206	Door latches and door hinge systems	X						RULE	1-1-69	incr. scope of pass. car lock requirements
2-16	Door latches and door hinge systems		X	X				NPRM		amends 206: adds vehicles
2-10	Emergency exits				X			ANPRM		new proposal
211	Wheel nuts, wheel discs, and hinge systems	X	X					RULE	1-1-68	

Std. or Docket No.	Title/Description	Pass. Veh.	Multi-pur. Pass. Veh.	Trucks	Buses	Trailers	Motorcycles	Status	Effective Date	Comments
	POST-CRASH: FIRE AND EXPLOSION									
301	Fuel tanks, fuel tank filler pipes and fuel tank connections	X						RULE	1-1-68	
3-1	Fuel tanks, fuel tank filler pipes and fuel tank connections	X						ANPRM		amends 301: increases performance requirements
3-2	Fuel tanks, fuel tank filler pipes and fuel tank connections		X	X	X		X	ANPRM		amends 301: adds vehicles
3-3	Fire retardant materials for interiors	X	X	X	X	X		ANPRM		new proposal

Std. or Docket No.	Title/Description	Pass. Veh.	Multi-pur. Pass. Veh.	Trucks	Buses	Trailers	Motorcycles	Status	Effective Date	Comments
	OPERATIONAL SAFETY AND OTHER: COMPONENTS									
4-1	Radiator caps	X	X	X	X			ANPRM		new proposal
4-2	Warning devices for stopped vehicles	X	X	X	X		X	ANPRM		new proposal
4-3	Motor vehicle jacks	X	X					ANPRM		new proposal
4-4	Odometers	X	X	X	X		X	ANPRM		new proposal
5-1	Federal Motor Vehicle Safety Standards							ANPRM		Vehicles less than 1000 lbs.

Key: ANPRM is an Advance Notice of Proposed Rule Making, or request published in the Federal Register asking for comments and suggestions to form a basis for a proposal for a standard.

NPRM is a Notice of Proposed Rule Making, or request published in the Federal Register asking for comments and suggestions on a specific proposed standard.

APPENDIX C

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
NATIONAL HIGHWAY SAFETY BUREAU
WASHINGTON, D.C. 20591

Highway Safety Program Standard

PERIODIC MOTOR VEHICLE INSPECTION

INTRODUCTION

Until recently there was very little firm evidence to support the reasonable supposition that State inspection systems contribute to highway safety. This deficiency has now been overcome, at least in part. Recent research demonstrates significant differences in State motor vehicle accident death rates associated with inspection programs. Although much more specific information is needed, especially with respect to the extent to which various kinds of inspection contribute to the overall results, it is clear that the inspection of motor vehicles by the States has an important place in highway safety.

BACKGROUND

> We will obviate the value of every program element involved in this effort if State safety programs do not include vehicle inspection requirements . . .
>
> Report No. 1700, House of Representatives
> 89th Congress, 2d Session, July 15, 1966,
> p. 12.

> . . . For example: We know today that only 21 States have legislation requiring periodic inspection of vehicles. General experience indicates that vehicles inspected are more often than not deficient in components that are important to safety.
>
> Report No. 1302, United States Senate
> 89th Congress, 2d Session, June 23, 1966,
> p. 6.

PURPOSE

To increase, through periodic vehicle inspection, the likelihood that every vehicle operated on the public highways is properly equipped and is being maintained in reasonably safe working order.

STANDARD

Each State shall have a program for periodic inspection of all registered vehicles or other experimental, pilot, or demonstration program approved by the Secretary, to reduce the number of vehicles with existing or potential conditions which cause or contribute to accidents or increase the severity of accidents which do occur, and shall require the owner to correct such conditions.

I. The program shall provide, as a minimum, that:

A. Every vehicle registered in the State is inspected either at the time of initial registration and at least annually thereafter, or at such other time as may be designated under an experimental, pilot, or demonstration program approved by the Secretary.

B. The inspection is performed by competent personnel specifically trained to perform their duties and certified by the State.

C. The inspection covers systems, sub-systems, and components having substantial relation to safe vehicle performance.

D. The inspection procedures equal or exceed criteria issued or endorsed by the National Highway Safety Bureau.

E. Each inspection station maintains records in a form specified by the State, which include at least the following information:

1. class of vehicle
2. date of inspection
3. make of vehicle
4. model year
5. vehicle identification number
6. defects by category
7. identification of inspector
8. mileage or odometer reading

F. The State publishes summaries of records of all inspection stations at least annually, including tabulations by make and model of vehicle.

II. The program shall be periodically evaluated by the State and the National Highway Safety Bureau shall be provided with an evaluation summary.

APPENDIX D

PRELIMINARY LISTING OF CANDIDATE ITEMS FOR PASSENGER VEHICLE SAFETY STANDARDS LISTED IN PRIORITY GROUPS*

System	Item	Criticality Category	Probability Category
	Safety Index A		
Steering	Linkage	II	I
	Bearings	I	I
	Drive Belt	II	I
Service Brakes	Master Cylinder	I	II
	Wheel Cylinder	I	II
	Caliper Assembly	I	II
Tires	Tires	II	I
Road Illumination	Headlight Assembly	II	I
	Safety Index B		
Steering	Entire System	I	III
	Hydraulic Booster	II	II
	Grease Seals	I	III
Service Brakes	Entire System	II	II
	Shoes	II	II
	Lines and Fittings	I	III
Suspension	Attachment Points	I	III
	Linkage	I	III
	Shocks and Stabilizer Links	II	II
Power Train	Auto Transmission	I	III
	Grease Seals	I	III
Windshield Assembly	Wiper and Washer	II	II
Road Illumination	Headlights	I	III
Communication	Turn Signals	II	II
	Brake Lights	II	II
	Brake Light Switch	I	III
	Running Lights	II	II

*There is no priority rank order within each group.

System	Item	Criticality Category	Probability Category
Hood	Entire Assembly	I	III
	Latch	I	III
	Safety Index C		
Steering	Wheel	I	IV
	Hydraulic Pump	II	III
	Steering Knuckles	I	IV
	Spindle Nuts	I	IV
	Wheel Studs	I	IV
Service Brakes	Pedal	III	II
	Linkage	II	III
	Drum	II	III
	Pad	II	III
Parking Brake	Entire System	II	III
	Lever	II	III
	Linkage	II	III
	Shoes	II	III
Wheels	Entire System	I	IV
Suspension	Entire System	III	II
	Springs	I	IV
Power Train	Engine	III	II
	Wheel Bearings	I	IV
	Studs	I	IV
Fuel Subsystem	Entire System	I	IV
	Accelerator	I	IV
Exhaust	Entire System	II	III
Cooling	Entire System	IV	I
	Fan Belt	IV	I
Electrical	Entire System	III	II
	Battery	III	II
	Ignition	III	II

System	Item	Criticality Category	Probability Category
Windshield Assembly	Glass	II	III
Windows, Side	Entire Assembly	II	III
Road Illumination	Headlight Switch	I	IV
	Dimmer Switch	I	IV
Main Structure	Entire System	I	IV
	Body	I	IV
Doors	Entire Assembly	I	IV
	Frame and Panel	I	IV
Fenders	Entire Assembly	I	IV
Bumpers	Entire Assembly	I	IV
	Safety Index D		
Steering	Flexible Coupling	II	IV
	Gearbox	III	III
Service Brakes	Disc	II	IV
Power Train	Clutch	III	III
	Universals	III	III
	Differential	III	III
	Case	II	IV
Fuel Subsystem	Carburetor	II	IV
	Fuel Filter	II	IV
	Pump	II	IV
	Tank	II	IV
	Fill Pipe	II	IV
	Cap	II	IV
	Lines and Fittings	II	IV
Exhaust Subsystem	Muffler	III	III
	Tailpipe	III	III
Cooling Subsystem	Radiator	III	III
	Water Pump	III	III
	Hoses	III	III

APPENDIX D (Cont)

System	Item	Criticality Category	Probability Category
Electrical Subsystem	Starter	III	III
	Fuses, Wires	II	IV
Windshield Assembly	Entire Assembly	II	IV
	Defroster	II	IV
Windows, Rear	Entire Assembly	II	IV
Mirrors	Rear	II	IV
	Side	II	IV
Road Illumination	Backup Lights	III	III
	Auxiliary Lights	III	III
Seat and Head Restraints	Entire Assembly	II	IV
Seat Belts and Anchors	Entire Assembly	III	III
Instrumentation	High-Beam Indicator	II	IV
	Turn Signal Indicator	II	IV
Heater	Entire System	II	IV
	Safety Index E		
Steering	Column	III	IV
Service Brakes	Power Booster	III	IV
Power Train	Gearbox	III	IV
	Propeller Shaft	III	IV
Fuel System	Intake Manifold	IV	IV
Exhaust Subsystem	Exhaust Manifold	III	IV
	Emission Control	IV	III
	Headpipe	III	IV
Cooling Subsystem	Radiator Cap	IV	IV
	Thermostat	III	IV
Electrical Subsystem	Alternator/Generator	III	IV
	Ignition Switch	III	IV
Communication	Horn	III	IV
	Reflex Reflectors	III	IV
	Hazard Flashers	III	IV

APPENDIX D (Cont)

System	Item	Criticality Category	Probability Category
Main Structure	Frame	III	IV
	Body Bolts	IV	IV
	Trunk	III	IV
Doors	Hinges	IV	IV
	Crash Locks	III	IV
	Handles	IV	IV
Hood	Frame and Panel	III	IV
	Hinges	IV	IV
Instrumentation	Speedometer	III	IV
	Battery-Charging Indicator	III	IV
	Fuel Gauge	III	IV
	Water-Temperature Gauge	III	IV
Window-Opening Mechanism	Entire Assembly	III	IV
Air-Conditioner	Entire System	III	IV

APPENDIX E

STATES REQUIRING OFFICIAL MOTOR VEHICLE INSPECTION OF ALL VEHICLES

STATE	TYPE*	YEAR ENACTED	YEAR OPERATIVE	NO. ANNUAL INSPECTION	ADMINISTERED BY	INSPECTION FEE	INSPECTION PERIOD
ARKANSAS	SA	1967	1969	1	Dept. of State Police	$1.75	Year round program
COLORADO	SA	1935 (revised '53, '57, and '59)	1936	2	Dept. of Revenue	$1.50	Year round program
DELAWARE	SO	1933	1933	1	Motor Vehicle Dept.	None	Year round program
DISTRICT OF COLUMBIA	SO	1938	1939	1	Motor Vehicle Dept.	$1.00	Year round program
FLORIDA	SA	1967	1968 (June)	2	Dept. of Public Safety	$1.75	Year round program
GEORGIA	SA	1963 (revised 1965)	1965	1	Dept. of Public Safety	$1.25	January thru June
HAWAII (Honolulu, Kauai, Hawaii, Maui)	SA		1961	1 or 2	Police Chief of each county	To be determined by each county	Year round program
IDAHO	SA	1967	1968	1	Dept. of Law Enforcement	$2.00	Year round program

* SA = State-appointed stations, SO = State-operated stations.

STATE	TYPE	YEAR ENACTED	YEAR OPERATIVE	NO. ANNUAL INSPECTION	ADMINISTERED BY	INSPECTION FEE	INSPECTION PERIOD
INDIANA	SA	1967	1969	1	Dept. of Vehicle Inspection	$2.50	Year round program
KENTUCKY	SA	1966	1968	1	Dept. of Public Safety	Not over $2.00	Year round program
LOUISIANA	SA	1960	1961	1	State Police	Not over $1.00	December thru March
MAINE	SA	1930 (revised '54, '57 '59 &'61)	1930	2	State Police	$1.00	Year round program
MASSACHUSETTS	SA	1926, '29 (revised '35, '51 and '61)	1930	2	Motor Vehicle Dept.	$1.00	April 1 - May 15; Sept. 1 - Oct. 15
MISSISSIPPI	SA	1960	1961	1	Dept. of Public Safety	$1.25	January thru March
MISSOURI	SA	1967	1969	1	State Highway Patrol	$2.50	Year round program
NEBRASKA	SA	1967	1969	1	Dept. of Motor Vehicles	$2.00	Determined by Dept. of Motor Vehicles
NEW HAMPSHIRE	SA	1930	1931	2	Dept. of Public Safety	Not fixed by law; $3.50 average	May and October
NEW JERSEY	SO	1936	1938	1	Motor Vehicle Dept.	$1.00	Year round program
NEW MEXICO	SA	1937	1959	2	Motor Vehicle Dept.	$1.00	Alternating months, Feb. to December

STATE	TYPE	YEAR ENACTED	YEAR OPERATIVE	NO. ANNUAL INSPECTION	ADMINISTERED BY	INSPECTION FEE	INSPECTION PERIOD
NEW YORK	SA	1954 (revised '66)	1957	1	Motor Vehicle Dept.	$3.00	Year round program
NORTH CAROLINA	SA	1965	1966	1	Dept. of Motor Vehicles	$1.50	Year round program
OKLAHOMA	SA	1967	1969	1	Dept. of Public Safety	$2.00	Determined by Commissioner
PENNSYLVANIA	SA	1928 (revised '37)	1929	2	Dept. of Revenue	Not set by law; Average $3.50 thru $5.00	Passenger cars: May 1-July 31; Nov. 1-Jan.31 Commercial: Feb. 1-Apr.30; Aug. 1-Oct. 31
RHODE ISLAND	SA	1958	1959	1 or 2	Motor Vehicle Dept.	$1.00	Year round program
SOUTH CAROLINA	SA	1967	1969	1	Highway Dept.	Not more than $1.75	Determined by Highway Department
SOUTH DAKOTA	SA	1967	1968	1	Division of Motor Patrol	To be established by Comm. of Div.	Determined by Commissioner of Div. of Motor Patrol
TEXAS	SA	1951 (revised '67)	1951	1	Dept. of Public Safety	$1.75	Sept. 1 thru April 15
UTAH	SA	1936, '53	1936	1	State Police	$2.25	Feb. 15 thru May 15

STATE	TYPE	YEAR ENACTED	YEAR OPERATIVE	NO. ANNUAL INSPECTION	ADMINISTERED BY	INSPECTION FEE	INSPECTION PERIOD
VERMONT	SA	1935	1936	2	Motor Vehicle Dept.	Not to exceed $1.00	May and October
VIRGINIA	SA	1932	1932	2	State police	$2.00	Year round program
WEST VIRGINIA	SA	1953	1955	1	Dept. of Public Safety	$1.25	Year round program
WYOMING	SA	1967	1967 (Oct.)	1	Dept. of Revenue	Not to exceed $2.00	Determined by Dept. of Revenue

SOURCES: Auto Industry Highway Safety Committee and National Highway Users Conference.

APPENDIX F

BIBLIOGRAPHY

Many of the conclusions presented in this report are the result of the analysis of source materials which relate to the problem of used motor vehicle safety. These materials include congressional hearings, administrative and technical publications of the Federal, State, and local governments, private engineering and technical reports, scientific papers, trade journals, and the press.

The following bibliography has been selected from among the large number of documents reviewed during the preparation of this report and is illustrative of the diversity of literature relevant to used motor vehicle safety. In addition, source material for this report was based on a thorough review and analysis of DOT communications and correspondence with the States, local governments, and numerous interested private organizations and individuals.

In addition, this report depends heavily on an interim report of a study on used motor vehicle safety prepared by Operations Research Inc., Silver Spring, Maryland under contract to the Department of Transportation. The final report on the Operations Research Inc. study is not due until 30 June 1968. It will be available in the Clearinghouse for Federal Scientific and Technical Information, U. S. Department of Commerce, Springfield, Va., 22151. Certain references which otherwise might not be readily available also have been placed in the Clearinghouse. These references are noted with an asterisk in the bibliography.

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APPENDIX G [1]

Automobile Ownership in 1975

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Almost four out of every five of the nation's households own an automobile. At the start of the decade, the ratio was three out of every four. Rising income, a shifting population age mix, and social change are altering the prevalence and patterns of automobile ownership. During the first seven years of the Sixties, our household population grew by 13% and the number of car owning homes by over 18%. Automobile registrations meanwhile increased by an estimated 28% because of a sharp rise in multi-car owning families.

The Bureau of the Census has recently completed an extensive survey of automobile ownership according to a number of major household characteristics. On the basis of those findings, it is possible to look ahead to the likely dimensions of the car market in the mid-Seventies.

Ownership by age and income

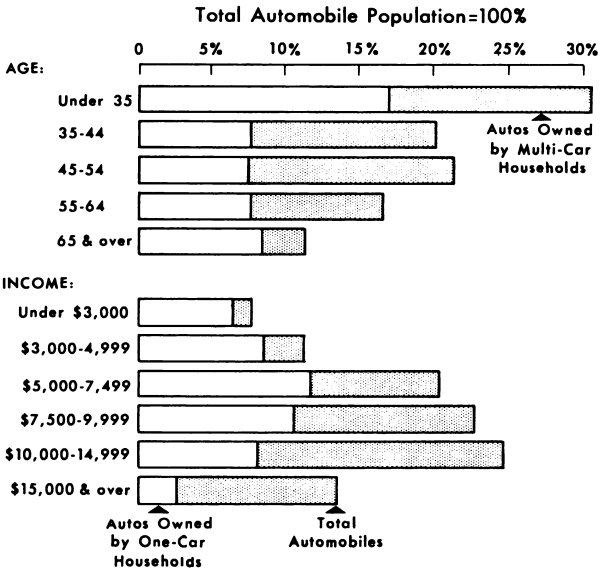
The family's economic fortune appears to be the single most important determinant of its car ownership status. For example, among households with earnings of less than $5,000 a year, 57% own cars; for those with $5,000-$10,000, the ratio is 92%; and for those in the higher brackets, 97%. Since both the young and the no-longer-young segments of the population include a relatively large number of persons with moderate earnings, car ownership rates for those age brackets are below average. But age, for the most part, is of minor account. When income is kept constant, the prevalence of ownership is remarkably similar for all age segments of the household population. The single significant exception is encountered in the 65-and-over age category where, for obvious reasons, ownership ratios are substantially below average at all income levels.

Multi-car households

While income is also an extremely important variable in determining whether the family owns more than one car, the age of the household head is also pertinent. The proportion of homes owning two or more automobiles increases dramatically as we move up the income scale. At the $10,000-and-over level, roughly three out of every five homes are multi-owners; at the $5,000-10,000 level, the ratio is less than one out of every three.

However, multi-car ownership rates are highest among households headed by persons ages 35 to 54. The income distribution profile has much to do with this since these are generally the peak earning years. Still, with earnings held constant, the frequency of two or more car homes varies quite distinctly by age of household head. For all income levels, the frequency of multi-

The Distribution of Automobiles by Household Age and Income in 1975



Sources: The U.S. Department of Commerce; The Conference Board.

[1] From The Conference Board Record, March 1968, published by The National Industrial Conference Board, New York.

car owning is above average for the 35-44 age category, and well above among homes headed by persons ages 45 to 54. After that the ratio declines abruptly.

This particular pattern reflects, of course, teenagers and young adults, a segment of the population primarily concentrated in households headed by persons ages 45 to 54, and to a lesser extent in the 35-44 bracket. By the time the head of the family reaches 55, many of the offspring have left home to form families of their own.

Ownership by residence

Automobile ownership also varies by place of residence, in part because of differences in transportation need, in part because of differences in income. Roughly four out of every five families located in non-metropolitan areas own an automobile, while in metropolitan sections the ratio comes to a fractionally lower three out of every four. In suburban communities, the ownership rate is a well-above-average 87%, but only two-thirds of those households located in central cities drive automobiles. However, since a larger number of households are located in town than in the suburbs, each of these locations accounts for about the same proportion of the total car population. Specifically, of all automobiles owned by the nation's families, slightly under 25% are registered in central cities, and just about the same proportion in suburban communities. About half of all other automobiles belong to households living in non-metropolitan areas.

The pattern of 1975

As observed, car ownership is to a considerable extent a factor of income, and to some extent, of stage in life cycle. Since both the age of the adult population, and household income distribution can be foretold with a reasonable degree of accuracy, it is possible to delineate, at least broadly, the probable patterns of automobile ownership for the period ahead.

Based on current figures, as reported by the Bureau of the Census, The Conference Board has evolved an age-income (in 1967 dollars) matrix of the nation's 1975 household population. The application of present car ownership ratios to the age-income classes anticipated for the mid-Seventies, provides some rough definition of tomorrow's car market. How precise a forecast this statistical operation provides is difficult to assess. Among other things, much depends on the extent to which current ratios will prevail in the future.

The evidence on hand does suggest, however, that the incidence of ownership for a given age-income population segment tends to remain reasonably constant over a modest time span. For example, based on relevant 1960 data, a simulated forecast was made of 1967 car

The Who of Car Ownership in 1975

All household-owned cars in 1975 = 100%

Household Income (in 1967 Dollars)	Total	Age of Household Head				
		Under 35	35-44	45-54	55-64	65 & over
Under $3,000	7.7	1.3	0.6	1.0	1.4	3.4
$3,000—$5,000	11.2	3.0	1.4	1.6	2.0	3.2
$5,000—$7,500	20.2	7.9	3.5	3.2	3.1	2.5
$7,500—$10,000	22.6	8.9	4.6	4.4	3.5	1.2
$10,000—$15,000	24.8	7.7	6.3	6.3	3.4	1.1
$15,000 & over	13.5	1.9	3.7	4.7	3.2	*
Total	100.0	30.7	20.1	21.2	16.6	11.4

* Percentage insignificant

owning household patterns. The results of this simulation were successful in foretelling the actual 1967 situation with a degree of accuracy well within the limits required for marketing-decision purposes. While this arithmetic is reassuring, it is probably less than surprising to the sociologist; in effect, the procedure outlined simply assumes that a family in a given income-age bracket in 1975 will behave in much the same way as his counterpart in today's environment.

It is estimated that in the mid-Seventies, 81% of the nation's households will own at least one car, and over a third of these, two or more. This will add up to about 80 million family cars on the road in 1975. These expectations imply some moderate slow-down in the rising incidence of car ownership and in the number of vehicles on the road. The number of automobiles owned by the nation's families has increased at an average annual rate of over 3.5% thus far in the Sixties, but the pace is expected to decelerate to about 3.0% between now and the mid-Seventies. These developments are based on the alterations anticipated for the years ahead in the age-income composition of the household population.

The impact of income

The changing profile of income distribution, past and projected, is contributing to a slowing in the growth of car ownership. With our rising prosperity, there is a continuous escalation in the income distribution scale. In the past, this process contributed appreciably to the expanding prevalence of automobile ownership, as large numbers of families moved from the lower to the middle income bracket. But more recently, the upward shift in the income distribution curve has had less of an impact on automobile owning ratios, since most of the nation's families are already sufficiently affluent to have cars. The critical income line of divide in car ownership status appears to be $5,000. For example, with age kept constant, barely two-thirds of all homes with less than that earning figure have a car, but in the $5,000-$7,500 level,

the ratio exceeds 90% and, of course, only a few points are gained after that.

Between 1960-1967, a large proportion of the nation's families moved from the lower to the middle rungs of the income ladder, making for a significant rise in the all-country incidence of car ownership. At the start of the decade. about half of the nation's households earned less than $5,000 a year (measured in 1967 prices); seven years later the fraction was 40%. In the time interval, many other families moved from the middle to the upper earning brackets, but they were already car owners before their fortunes had improved.

Between now and the mid-Seventies, the income distribution curve will continue to rise, but relatively fewer households, as compared to the years just gone by, will cross the crucial $5,000 income line for the simple reason that the population of the lower brackets has already thinned out. The main thrust in the years to come will consist of a sharp rise in the number of persons with earnings in excess of $10,000. While this development will have an important consequence on the type of automobiles likely to be in demand, it will not significantly affect car owning ratios.

The rate of expansion in the number of multi-car homes witnessed in recent years is also expected to level off appreciably between now and the mid-Seventies. In 1960, about 16.5% of all households had more than one car, and by early 1967 the ratio had grown to an impressive 25%. For 1975, it is projected at 28.5%, a relatively modest elevation as compared to the recent past.

This moderate expectation is largely based on scheduled shifts in the nation's population age mix. In recent years, there have been only minor changes in the relative importance of the various age population segments. The rise in the incidence of multi-car owning homes resulted from the growth in the size of the middle and upper income brackets. Between now and the mid-Seventies, however, the 35-54 age group is slated to remain about the same in number, and hence will become less important in relative terms. It will decline from roughly 40% of the population to less than 35%. This age category, as observed earlier, has an impressively high multi-car owner rate. In the meantime, households headed by persons under 35—where two-car home families were encountered with well below average frequency—are expected to increase from roughly 24 to 30% of the population by 1975. Thus, demographic developments in the coming period will have an adverse effect on the growth of the two-car family. There will, however, be some modest expansion in this area because affluent households will become considerably more numerous.

Changing segmentation

The shifting population age mix in conjunction with the re-shuffle in income distribution is altering the segmentation of the nation's automobile market. The accompanying table provides a projected 1975 matrix of family car ownership by household age-income classes.

As previously emphasized, the major development anticipated in the changing automobile ownership pattern is a shift in the direction of younger households and more prosperous ones. Currently, 25% of all family cars on the road are driven by household heads under 35; by 1975 the figure will exceed 30%. The 35-54 age category will account for relatively fewer automobiles, with its importance declining from 47 to 41%. Households headed by those aged 55 and over will remain about as important as now.

Changes will be large in the income dimension. About 30% of all cars now belong to homes earning $10,000 and over, but this ratio will exceed 38% by 1975 (measured in constant dollars). The middle class—those with earnings of $5,000-$10,000—now accounts for roughly 45% of all cars, and this ratio is expected to remain about the same. Homes with earnings under $5,000 will own less than one out of every five cars in 1975, compared to one out of every four now.

The most dramatic change in ownership patterns will be experienced among families under 35 and with earnings exceeding $7,500. Currently, that market accounts for less than 11% of all family cars, but by 1975 it will rise to 18.5%. However, homes headed by persons 35 to 54, and with earnings of over $7,500, will continue to constitute by far the most important segment of the automobile market. Currently, this group owns 28% of all vehicles, but by 1975 the figure will be 30%. Although the importance of this particular age bracket, as noted, will diminish, the proportion of homes with earnings exceeding $7,500 will increase significantly. Households with incomes of over $7,500 and headed by persons over 55 will account for about one out of every eight cars in 1975, which is moderately higher than now.

On balance, the well-to-do young family will represent a more important factor in tomorrow's car market. However, families in the middle years of the life cycle will still make up by far the industry's largest group of customers.