

# Highway Transportation and Factors Affecting Highway Finance

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Transportation is a basic service function essential to the agriculture, commerce, industry, and defense of the United States. It is not an end in itself, but rather it is a means to many ends; and because of this, its true significance is amplified and reflected as its influence diffuses through the economy. Its economic significance is revealed in that a considerable portion of the annual expenditure for goods and services is for transportation. By 1947, annual expenditures for all transportation services in the United States had exceeded \$40 billion. Nearly half of this expenditure was for the private auto—total highway expenses were well over one-half of all expenditures for transportation services (1, 2). Today, the cost of transportation is estimated to approach 15 to 20 per cent of the national income.

## GROWTH OF TRANSPORTATION

The demand for transportation services has closely paralleled many of the factors affecting the prevailing economic conditions. Similarly, the demand for certain transportation services has fluctuated, but, in general it has increased for each available type.

The development and the magnitude of intercity freight transportation in the United States during the past quarter century is graphically portrayed in Figure 1, *Ton Mileage of Various Transportation Agencies, 1926-1951*. The effects of the depression years of the 1930's and of the emergency during World War II are clearly indicated. In general, the demand for each form of intercity freight movement is growing (3, 4, 5, 6). The index of growth is further illustrated in Figure 2, *Indexes of Freight Transportation*. These index curves, derived from data prepared by the Interstate Commerce Commission, show that between 1939 and 1949 intercity motor freight

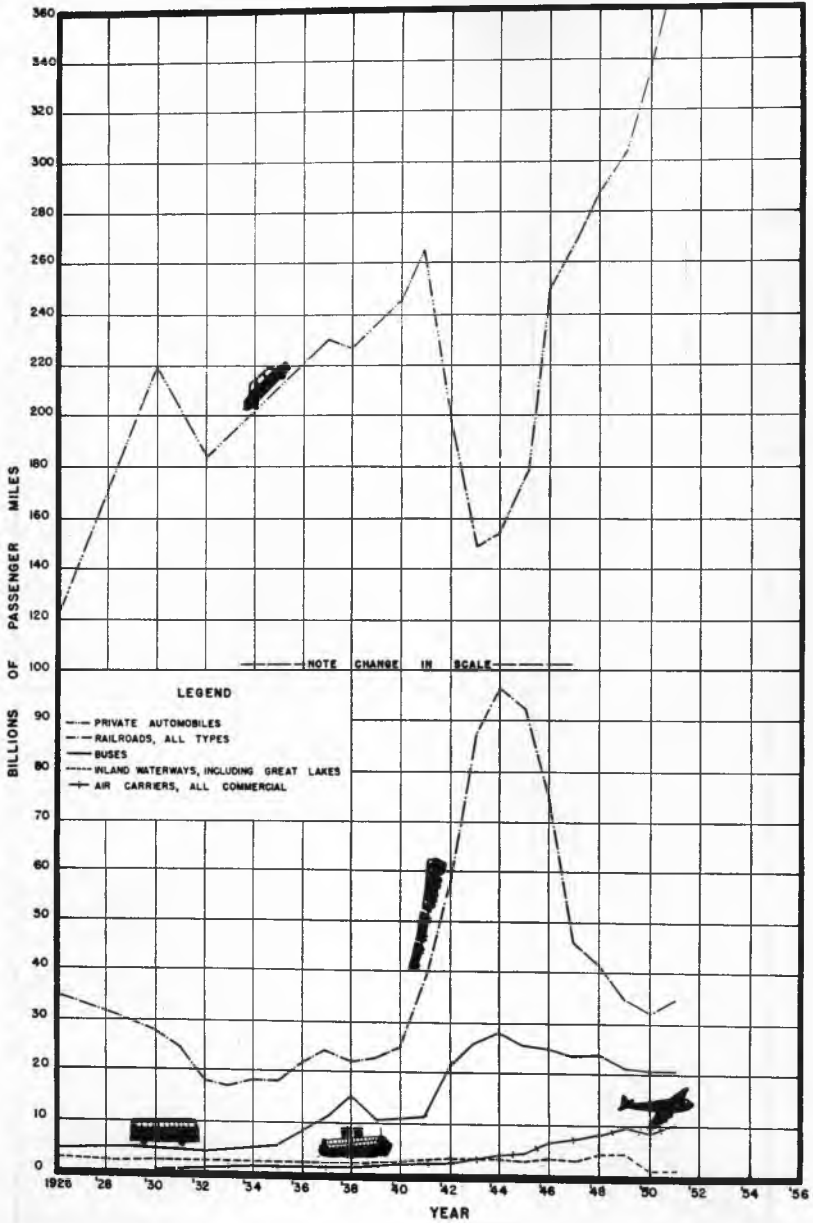


Fig. 1. Ton Mileage of various transportation agencies 1926-51. Intercity traffic only.

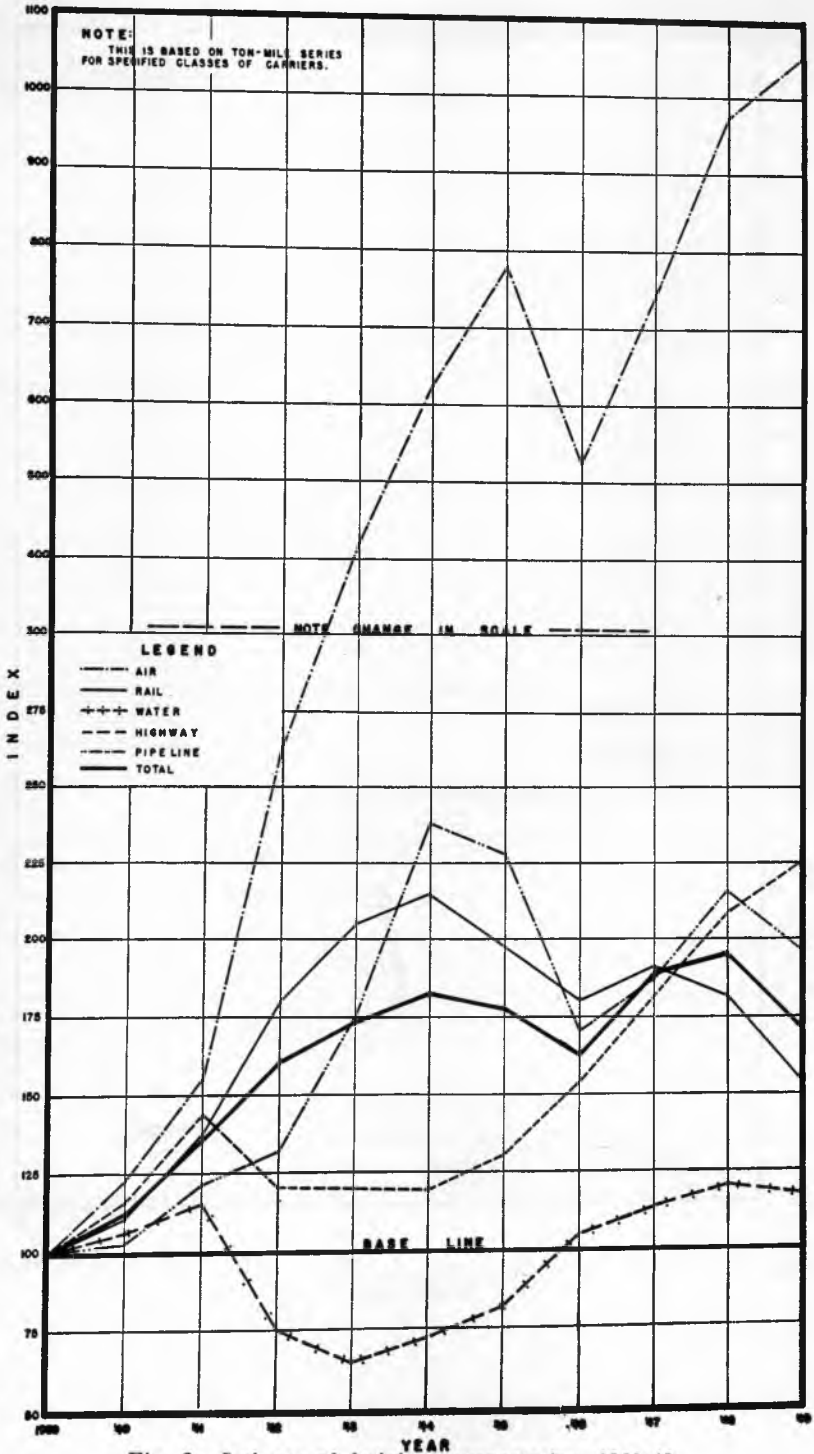


Fig. 2. Indexes of freight transportation 1939-49.

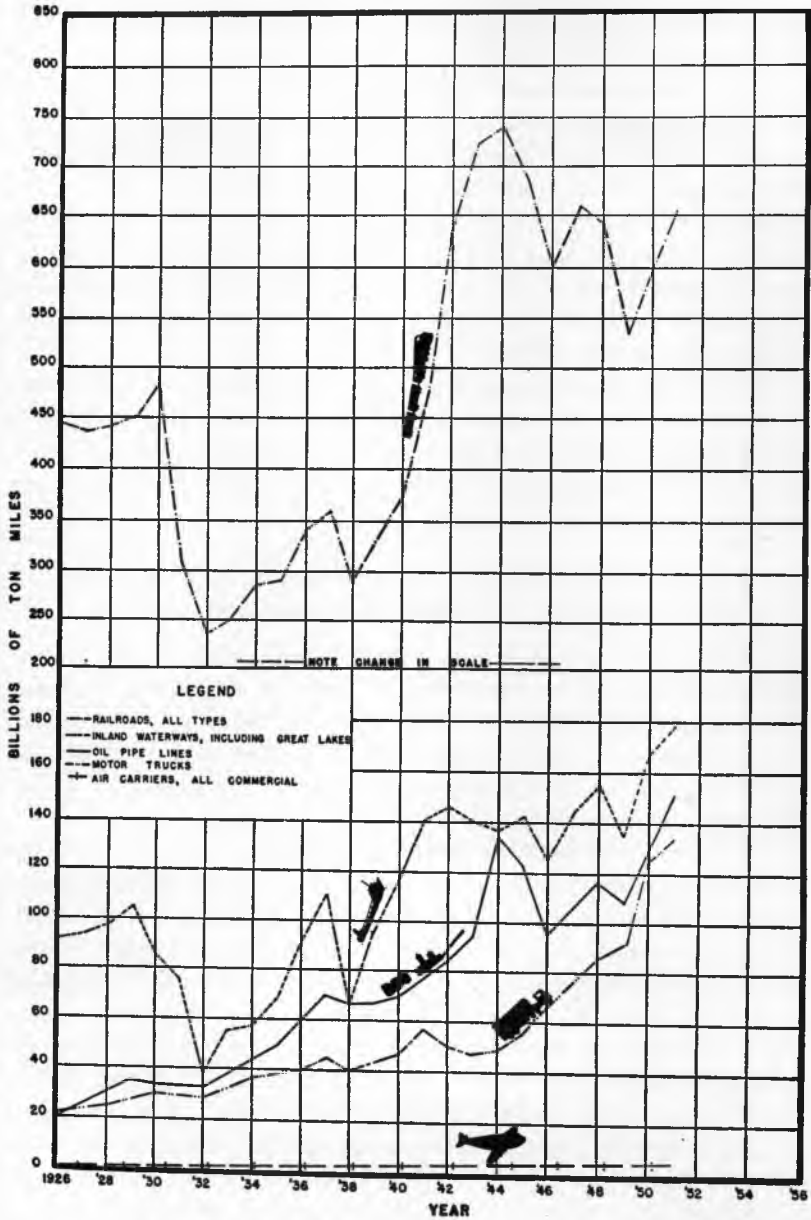


Fig. 3. Distribution of passenger mileage among transportation agencies 1926-51. Intercity traffic only.

transportation gained 125 per cent; rail, 53 per cent; water 16 per cent, pipeline, 97 per cent; and air carrier, 941 per cent (3).

The development and magnitude of intercity passenger transportation is portrayed in Figure 3, *Distribution of Passenger Mileage Among Transportation Agencies, 1926-1951*. Each form of passenger transportation is illustrated by a significant growth curve (3, 4, 5, & 6). A detailed analysis of the growth data will show that in recent years nearly 85 per cent of the intercity passenger transportation has been by the private automobile. The private automobile has become a necessity to the user and is a competitor among other forms of passenger transportation.

The transportation system of the United States is complex and a discussion of its development, especially of each form included in the system is beyond the scope of this presentation. Several factors, however, affecting the development of highway transportation are presented in considerable detail.

#### CERTAIN FACTORS AFFECTING THE GROWTH OF HIGHWAY TRANSPORTATION

The growth of highway transportation and certain factors affecting its growth are illustrated in Figure 4, *Growth of Highway Transportation and Related Factors*. These curves, which were plotted from indexes of growth, using 1940 as a base year illustrate the trends in gross national product, motor vehicle registrations, annual mileages, and population growth.

The growth of highway transportation has paralleled the increase in the gross national product which attained an estimated \$329 billion in 1951 (7) and is expected to double by 1975. If motor vehicle registrations continue to increase as in the past the combined registration of automobiles, trucks, and buses which was about 53.3 million in 1952 (8 & 9) may reach 85 million in 1975. Similarly, motor truck registrations may be expected to increase from the current estimate of nearly 10 million to about 20 million during this period. An analysis of the economic growth of the trucking industry indicates that there will be changes in the design of the vehicles to facilitate their use and to accommodate the ever increasing gross and net loads. An examination of the growth curve for annual vehicle miles shows that there will be an increase of about 4 per cent per year until 1960 and that by 1975 annual vehicle miles may be expected to exceed one trillion miles.

The population of the United States increased from about 108 million in 1921 (10, 11) to about 156 million in 1952. A projection

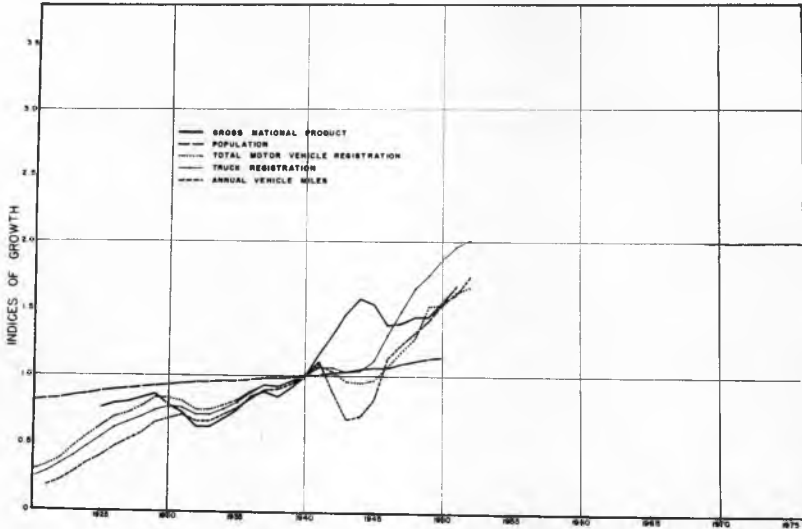


Fig. 4. Growth of highway transportation and related factors (base year—1940).

of the population curve, as illustrated in Figure 4, indicates that by 1975 the population will approach 185 million. This assumes high fertility, low mortality, and high immigration as reported in predictions by the Department of Census (11, Table VII). Census data also reveal a significant trend toward urbanization. Urban population has changed from less than 40 per cent of the total population in 1900 to nearly 64 per cent of the total in 1950 (12). It must be noted, however, that the definitions of urban and rural population as used by the Bureau of the Census in the 1950 census, may have had a significant effect upon these data. This difference in definition may account for the decline in rural population as shown in Table I.

By 1950, there were 76 urban communities in the United States with populations of over 250 thousand and more than one-half of the population lived in 168 metropolitan areas. Furthermore, about 80 per cent of the increase in the total population, 1950 over 1940, took place in the 168 metropolitan areas (12). These changes in population will continue to influence the development of the highway transportation system.

Rural road mileage increased from about 2,151 thousand miles in 1904 to 2,925 thousand miles in 1921, but between 1921 and 1951 the increase in mileage was less than 3 per cent (8, 13). It is expected to decrease in the future as many low-density traffic roads are abandoned to the property owners. Street mileage in urban areas

TABLE I  
Distribution of Population, 1870-1950 (12)

<i>Year</i>	<i>Total (millions)</i>	<i>Urban (millions)</i>	<i>Rural (millions)</i>	<i>Percent Urban (approximate)</i>
1870	38.6	9.9	28.7	30
1880	50.1	14.1	36.0	28
1890	62.9	22.1	40.8	35
1900	76.0	30.2	45.8	40
1910	92.0	42.0	50.0	46
1920	105.7	54.2	51.5	51
1930	122.8	69.0	53.8	56
1940	131.7	74.5	57.2	57
1950	150.7	96.0	54.7	64

increased from 258,367 miles in 1920 to more than 319,000 in 1951 (*ibid*) and it should be expected to continue with the trend toward urbanization. Concurrently, the federal aid system of roads and streets increased from about 7 per cent in 1921 to about 22 per cent of all roads and streets in 1951 (*ibid*).

These changes in rural and urban mileages are the result of many factors, but among them, the basic changes in the principle of federal grants-in-aid to the states on a matching basis appears to be paramount. The principle of grants-in-aid to the states for the construction of rural post roads was established in 1916 and amended in 1921 to include a system of the important interstate and inter-county highways, but not exceeding 7 per cent of the total mileage in each state (14, 15). This limiting principle has been abandoned, especially in the granting of aid for the development of secondary or farm-to-market roads. The grant-in-aid principle was supplemented during the national emergency of the 1930's, first by direct grants on work-relief programs and later by the extension of the matching process to the development of a system of farm-to-market and secondary roads (16). Further implementation of the principle was established in 1944 and by subsequent legislation which extended grants-in-aid to the development of urban arterials and to the Interstate Highway System (17, 18, 19, 20). These trends indicate a change in emphasis on road systems, and that additional road and street mileage may be expected in the federal aid systems of the future.

The service demand on the roads and streets increased several-fold in the interval 1921-1952. The increase in the number of motor

vehicle registrations (about 10.5 to 53.3 million) does not give an adequate measure of the service demand. To be sure their number is important, but increases in their general operating characteristics—speed, horsepower, weight, width, length, interchangeability, and others have placed new demands on the highway system. In the next quarter century, the estimated increases in these factors—total motor vehicle registrations increasing 60 per cent, population increasing 25 per cent, and annual vehicle miles increasing 100 per cent—will inevitably result in greater service demands and increased congestion on the roads and streets unless greater emphasis is placed upon the development of an adequate financial program.

### BASIC HIGHWAY NEEDS STUDIES

The development of a financial program to provide for the current system of rural roads and streets was facilitated by certain basic studies. The early transportation studies conducted principally by state and local agencies during the period of 1922 to 1928; the state-wide-planning surveys initiated in 1934; the highway needs studies initiated in the early 1940's; and the urban origin-destination studies, 1944 to date, have contributed to a fund of knowledge essential to highway planning and programming (21, 22, 23, 24). If we expect to attain an adequate highway system the highway needs studies must be reviewed and revised at frequent intervals because of the dynamic growth of highway transportation. Many studies of the cities and urban areas must be made if we are to relieve traffic congestion in or near them. Further study of the secondary and farm-to-market roads should be made to determine needs and financial responsibility. In addition, studies should be made to determine how much the various classes of users and beneficiaries of highways should contribute to the construction and maintenance of an adequate highway system. The studies of a decade or two ago are of little value in determining this responsibility due to the dynamic character of highway transportation. Studies depicting current and future needs are essential to the development of a proper financial program.

### EXPENDITURES AND FINANCIAL NEEDS

Expenditures exceeding \$75 billion by federal, state, and local governments have been made in support of the vast system of roads and streets (25). Current annual expenditures exceed \$5 billion (including new borrowings in 1951) and may be expected to reach \$6 to \$8 billion within the next two decades. Estimates of highway



needs indicate that the current rate of annual expenditures represents about 60 per cent of the funds needed to develop an adequate highway system in 15 years. The American Association of State Highway Officials reported in December 1951 that nearly two-thirds of the roads in the Federal Aid Systems (219,000 miles of primary roads, and 429,000 of secondary roads) were inadequate and that about \$32 billion would be needed to make them adequate for traffic demands (26).

### FEDERAL GRANTS-IN-AID TO HIGHWAYS

A summary of the authorizations shows that federal grants-in-aid to the states for highway construction, have exceeded \$8.6 billion. This includes the \$1 $\frac{1}{3}$  billion authorized under the Federal Aid Highway Act of 1952 for the two-year fiscal period ending June 30, 1955. (27). The American Association of State Highway Officials report, previously mentioned, recommended that the 1952 Act should include federal aid at the rate of \$810 million per year. Much of the increase would have been for primary highways. Their proposal would have increased federal aid from about 17 per cent of the total expenditures for construction on the primary highways in 1951 to about 25 per cent of expenditures for construction on the primary highways in a ten year program. It is obvious that AASHO and many others in daily contact with the highway problem are interested in emphasizing the primary highway system and that an adequate long-term financial program is necessary to achieve this objective.

### INCREASE IN FEDERAL AID

The history of Federal grants-in-aid to highways indicates that the Federal government has assumed increased responsibility for the highway system (1, 3, 13, 28). Mileages in the federal aid systems increased more than fourfold in 30 years—169 thousand in 1923, nearly 220 thousand in 1935, and 670 thousand by mid-year 1952. Federal activity was limited to grants-in-aid to the main rural roads prior to the work relief programs of the 1930's and to the extension of financial assistance to secondary and farm-to-market roads in the mid 1930's. The activity was increased in 1944 when federal aid to urban areas was authorized and the development of the Interstate Highway System was proposed. The Records of the Bureau of Public Roads show that by mid-1952 nearly 22 per cent (219,000 primary and 436,000 secondary) of all rural roads were in the federal aid systems which carried over 80 per cent of all rural travel. The

Federal Aid Highway Act of 1952 gave recent impetus to the development of an Interstate System of the principal rural highways which includes slightly more than one per cent of the main rural highways, but which carries at least 20 per cent of all rural travel. The federal government has also assumed greater responsibility for arterial development in urban areas. By 1952 the Federal Aid system included more than 16,000 miles of urban streets. During this time the federal government has not only assumed increased financial responsibility, but federal participation has had a salutary effect upon the development of uniformity in engineering and administrative standards and procedures.

### POLICY CHANGES IN THE 1952 ACT

A significant change in the grant-in-aid policy was established by the 1952 Act when \$25 million was authorized for the Interstate System and \$50 million for defense access roads (27). Although the basic law for the Interstate System was established by the Act of 1944, this was the first direct grant to the system. The 1952 Act provided that grants for defense access roads may be used for the construction or improvement of expressways or by-passes upon proper certification as being essential to the national defense. The total funds of the 1952 Act indicate the interest and increasing responsibility assumed by the Federal government in the improvement of conditions on the primary highways and in urban areas where traffic congestion restricts through traffic and defense activities.

### REVENUES FOR HIGHWAYS

Highway administrators, economists, and engineers, however, are faced with the need for developing additional funds to meet the accelerated demands on the highway. Even though the federal government has assumed increased financial responsibility, nearly 90 per cent of all funds for the highways must be developed at the state and local level (8).

### MOTOR FUEL TAXES

Although the states derive the bulk of their road funds from motor fuel taxes they are competing with the federal government for this source of revenue (29, 30). Recent increases in motor fuel prices, however, have not paralleled the increase in motor fuel taxes (46).

Figure 5, Trend in the Price of Gasoline, shows that between 1939 and 1951 the selling price of gasoline at the service station (excluding tax) increased 52.5 per cent (13.31-20.31) while the average tax increased only 25.8 per cent (5.44 to 6.84 cents) during this period. In 1939 the tax was about 40.8 per cent of the selling price (excluding tax); in 1951 it was only 33.6 per cent. With the highway dollar purchasing less than 50 per cent of what it did in 1939, does this indicate that the states and the federal government collect sufficient funds for highway purposes from this source of revenue?

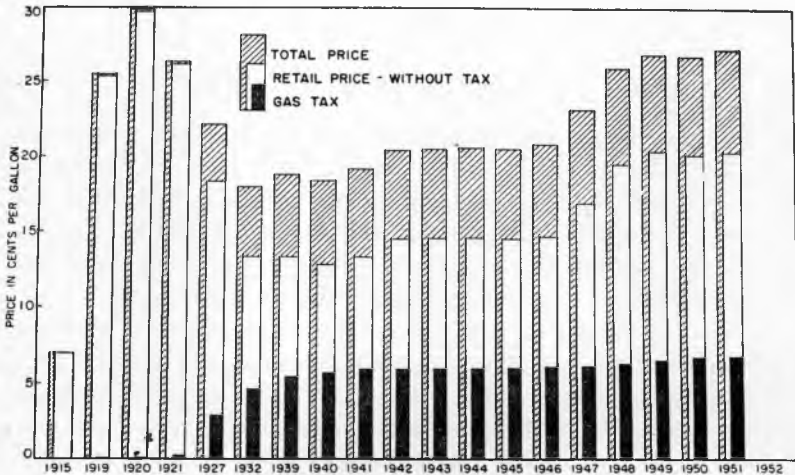


Fig. 5. Trend in the price of gasoline.

State taxes on gasoline in effect on December 31, 1952 varied from 3 cents in Missouri to 7 cents in Florida, Kentucky, Louisiana, Mississippi, North Carolina, and Tennessee (31). All states except Idaho, Nebraska, and Vermont had taxes on Diesel fuel and liquid petroleum. The tax rate on highway fuels other than gasoline differed from the rate on gasoline in Michigan, Mississippi, Nevada, New York, Texas, and Wyoming. Additional registration fees were imposed on vehicles using special fuels in Nebraska and Vermont. In Idaho a mileage tax was charged in lieu of gallonage taxes on special fuels (*ibid*). Federal tax on Diesel fuel is limited to fuel used for highway purposes. Thus, this federal excise tax on Diesel fuel is discriminatory. The determination and comparison of the relative efficiency of motor vehicles using the several types of fuels is needed to determine the amount of financial responsibility of the motor vehicle.

The states collected about \$1.8 billion in motor fuel taxes in 1951 (32), and when final returns for 1952 are available the sum collected should be about \$2 billion. The federal government collected nearly \$600 million in fuel taxes paid by highway users in 1951 (33) and the estimated income for 1952 is more than \$800 million. The states and the federal government collected about \$2.4 billion in motor fuel taxes in 1951 and they should collect about \$2.8 billion in 1952.

The states began collecting motor fuel taxes in 1919; the federal government in 1932 (29). The states use most of these funds for highway purposes. Certain states, however, consider the income derived by this method as a part of the general funds and distribute it according to the needs of government. The Bureau of Public Roads has reported that diversion of highway user revenues to non-highway purposes reached an all-time dollar high in 1952 when 26 states diverted \$267 million despite the fact that 21 states had anti-diversion amendments. This situation may improve because half of the states now have anti-diversion amendments.

The motor fuel taxes collected by the federal government are excise taxes and as such are placed in the general budget (29, 30). Congress allocates grants-in-aid to the states on the basis of needs and in terms of prescribed formulas (27, 28).

There is no direct connection between federal funds derived from federal excise taxes on motor fuels and the allocation of grant-in-aid funds to the states for highway purposes (29). However, in recent years the federal funds derived from motor fuel excise taxes have closely paralleled the grants-in-aid to the states. The "linkage" between these funds became more pronounced when Resolution No. 5 "Increased Federal Aid to an Amount Equal to Gasoline Tax Collected by the Federal Government" was recently approved by the American Association of State Highway Officials (36). It is apparent that linkage implies a distinct departure from the principle of federal aid and that it might serve as a deterrent from the policy by emphasizing inequities in the allocation of funds. Certain states might request a greater share of the revenues. Legislation submitted to Congress in early 1953 is further evidence of this linkage factor.

Most states are desirous of eliminating the Federal government as a competitor for funds derived from motor fuel taxes and have approved legislative resolutions to initiate legislation by Congress. The states may succeed in eliminating the Federal tax on motor fuels, but recent legislative proposals in the states indicate that they will be reluctant to reduce the total cost to the highway user because of the needs for additional highway funds. States with high traffic den-

sities—New York, New Jersey, Indiana, and California might consider it profitable to eliminate the federal government as a competitor for these funds, but states with low traffic densities—Arizona, New Mexico, North and South Dakota would not find it as desirable. Furthermore, state highway departments and others within the industry may desire to eliminate federal excise taxes related to highway transportation, but it is doubtful that they would be willing to forego the benefits of federal aid or some other uniform approach to the highway problem.

The Executive and Legislative branches of the Federal government may oppose and defer elimination of the Federal government from this source of funds which in 1951 represented about 1.3 per cent (29) of the total internal revenue collections. A change in policy or a reduction in federal expenditures must necessarily precede the elimination of sources of revenue.

Several basic problems center around this controversy. Among these are:

1. Should the federal government assume an ever increasing role in the highway transportation?
2. Would the federal government stop grants-in-aid to the states if it stopped collecting motor fuel taxes?
3. Would the salutary effects of federal interest in standards, research, and improvements disappear?
4. Would a continuation involve a shift in emphasis—for example to the Interstate Highway System?
5. What effect will continuation or elimination have on the toll method of finance?

### MOTOR VEHICLE FEES

The second major source of highway funds is that of assessments for motor vehicle registrations, driver's licenses, and others of similar character. Nearly \$900 million was collected by the states in 1950 and about \$1 billion was collected in 1951 (8). The growth curves for motor vehicle registrations, driver's permits, and others indicate that this source of highway revenue will continue to increase during the next 25 years. Furthermore, unit fees for certain vehicles may also increase.

In 1952 the registration fees for the light passenger car varied from \$3.00 in Alabama and Louisiana to nearly \$29 in Iowa. In general, those states with a high registration fee usually have a low gas tax rate. Indiana with a \$11 fee for the light passenger car is

slightly below the national average of about \$12. A recent study by the Bureau of Public Roads shows that the average taxes paid for the light passenger car, including property tax, is about \$59 per year (38). This is a small annual investment by the average motorist for the privilege of driving 10,000 miles per year. In fact, it is less than 6/10 cent per mile. It is less than 10 per cent of the average operating cost of this motor vehicle. The overall average of highway imposts for all vehicles is less than one cent per mile.

### OTHER METHODS OF FINANCE

In recent years there has been a tendency to assess additional highway imposts by "third level" taxes such as the weight-distance tax in New York and Oregon. The advantages and disadvantages of this system are not obvious and are being extensively debated (39, 40, 41).

Since World War II there has been an increasing tendency to finance roads with borrowed money, which in most cases is being repaid from revenue of the special motor fuel taxes and license fees. In other cases borrowed funds are used to construct toll roads and bridges and the tolls are used for debt service, operation costs, and maintenance. The States (exclusive of local road and urban units) have borrowed more than \$1 billion since World War II. Of this total, more than \$500 million was obligated in 1951 (8, 42, 43).

Many states are interested in the toll road method of finance (39, 42, 44, 45). Nearly 850 miles of toll roads are in service; slightly less than 800 miles are under construction, and about 700 miles have been authorized. About 2,400 miles are expected to enter the construction phase within the next 2 years and some 3,000 miles are pending legislative authority. The toll road process is not new, nor does it necessarily fit into an adequate transportation pattern. Much can be said of the similarity of current developments with those of a century ago. Toll road development diverts public interest and the interest of legislative bodies in the development of an adequate highway system. In addition, by sidetracking the usual highway problems for the development of toll roads, there is a diversion of manpower and technical know-how. It is doubtful that the toll road method of finance is the answer to the difficult highway finance problem. It is conceivable that this method of finance may initiate legislative action at the national level to increase grants-in-aid, or to develop a long term financial program for the most important highways.

The real crux of the problem appears to be not only the need for an adequate national transportation policy, but for the development of a technique whereby the various classes of users and other beneficiaries may be assessed their fair value of the benefits derived from the several classes of highways. This is further complicated by the technological changes in highway transportation equipment which may affect the current and prospective methods of assessing highway user imposts. Developments in fuels and motive power tend to highlight the need for improving the tax basis.

### TRENDS IN HIGHWAY PROGRAMMING AND DEVELOPMENT

The greatest immediate need for highway transportation today is for additional funds and for more effective use of the funds in terms of an adequate transportation policy. Increased federal aid, higher motor fuel taxes and registration fees, new "third level" taxes, proposals to link revenues from federal excise taxes to federal aid to highways, multiple taxation, and the growing number of toll roads are representative of efforts to solve the financial problem. This is complicated by the growing demand for an adequate transportation policy. But it is recognized that there are limits to the availability of funds for highways. For this reason many States and municipalities have prepared fundamental studies of their long range highway needs and have attempted to outline rational financial plans to meet these needs over a period of years. Many of these highway needs studies have gained wide public support and have formed the basis of future state highway development in about half of the states (21, 22, 23, 24, 47, 48, 49). These studies must be re-evaluated frequently because of the dynamic character of highway transportation. The recent studies of congestion problems in or near urban areas have become a regular part of the needs studies. The development of expressways, by-passes and other physical facilities will be fruitless unless the states develop an adequate legal program to protect these facilities from encroachment by the public.

The growth of public acceptance of highway needs has been accompanied by the development of more scientific methods of project selection (23). The development and use of "sufficiency ratings" tends to formulate a composite picture of the structural condition of the highway, its ability to carry traffic, and its degree of safety. Recent evidence shows that more than 20 states are using the basic principles of sufficiency ratings as a basis of selecting highway con-

struction projects. Further acceptance of scientific methods at the state and local level is essential to effective development of the highway finance program.

The development of PAR (Project Adequate Roads) which is similar to earlier "good roads" movements may facilitate the highway program (50). It may expedite the development of the Interstate Highway System, improve the urban arterial systems, and reduce the emphasis placed on the secondary and local roads. In addition PAR may influence formulas for the distribution of federal and state funds for highway purposes.

### SOME BASIC PROBLEMS

The problem for finding sufficient funds and appropriate methods for developing an adequate system of highways is challenging. But there remain many questions that must be resolved, both at the national and state levels, before the solution to the highway problem is in sight. The progress that has been made in the use of basic highway needs studies and the acceptance of modern programming methods have been relevant to state and local governments, and even here the field has received only partial coverage. Such state by state analyses are essential if fundamental responsibility for the highways is to remain at the state and local level. These analyses cannot function effectively so long as basic problems of transportation at the national level remain. Some of the problems needing comprehensive study are:

1. What should the attitude of the federal government be toward an adequate transportation policy?
2. Does highway transportation compare favorably with other forms of transportation in making an equitable contribution toward the economic, social, and political development of the country and to the national defense?
3. What is the place of highway transportation in the national transportation policy? How should promotional and regulatory policies be developed?
4. What is the place of the federal government in highway finance? Should the federal aid principle be extended, or should some other types of federal participation be considered?
5. Is the toll road movement justified and what should federal policy be toward the development?



6. How should the several classes of users and beneficiaries of highways contribute to the cost of the several classes of highways?
7. What are the highway needs of today and the foreseeable future, and how shall the costs and benefits be related?

Further discussion of the topics presented in this paper and answers to these comprehensive questions are urgently needed to determine the place of highway transportation in an adequate transportation system that serves agriculture, commerce and industry, and the national defense.

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