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D. M. BEACH, *Editor*

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FINANCING OF LOCAL ROADS AND STREETS

REPORT OF DEPARTMENT OF HIGHWAY FINANCE, HIGHWAY RESEARCH BOARD, NATIONAL RESEARCH COUNCIL [1]

Presented by THOS. H. MACDONALD, Chief, Bureau of Public Roads, Chairman

CONSIDERATION of present and past methods of highway financial administration reveals slow progress toward a rational spending program. Demands for increased highway appropriations have in many cases diverted attention from the need for wiser spending of what we have and more efficient managing of what we spend. Design, construction, and maintenance standards have kept reasonable pace with modern transport tempo, but policies of administration and finance remain essentially horse-drawn.

Highway tax distribution and the administrative difficulties involved have been examined with particular reference to local application of State funds for highway purposes. Last year more than a quarter of a billion dollars in State gasoline taxes and registration fees were set aside for roads and streets not on the State highway systems. This money was 25 percent of total motor-vehicle tax collections for 1936. The large part of highway-user taxes so distributed is an index of the need for studying methods of allocating such funds to local governments, for establishing an economic basis for shared taxes and State aid, and for inquiring into the uses to which these funds are now applied, the degree of financial control retained by the States, and the fiscal and managerial pitfalls into which both State and local governments spend their way.

Vehicle taxes for local roads.—That highway users should be charged in accordance with their utilization of highway facilities is the generally accepted theory upon which the gasoline tax and registration fee are established. It appears to follow therefore that the distribution of such taxes to various parts of the highway system should reflect the relative traffic volumes which they carry.

In the period of rapid highway expansion which paralleled the growth of motor-vehicle travel, the theory that those who used the roads should pay for them was generally conceded, but financial pressure created by the need for a new system of main roads made it neither possible nor desirable to adopt the corollary that funds should be spent with exact regard to their origin. With the progress of a primary system of highways which such concentrated finance made possible, however, there originated in both counties and municipalities a demand that some part of State tax collections be returned for local roads and streets. Today the wide range in relative proportions of funds made available to local governments suggests no more scientific consideration than the loudness of these demands. In 1936, 3 States returned more than half of total highway user imposts to local units of government, 11 over one-third of such collections, and 5 States made no allotments whatever. Local roads in 1 State received 24 million dollars in State taxes, while in each of 10 other States less than a million dollars were distributed for highways in local jurisdictions.

Tax distribution laws.[2]—State laws governing the amount and basis of gasoline tax and registration fee distribution comprise a legal labyrinth which varies in complexity from State to State. Two considerations are involved: Determination of the total which shall be distributed by the State; and the division of this sum among the various local units. The total share going to local roads is generally expressed as a percentage of collections, a specific part of each tax levied, or a predetermined flat sum. The allocation to each local unit may then be made according to the population, area, assessed valuation, road mileage, or on the basis of vehicle registrations or tax collections. In the case of the registration fee, however, shares are often retained by each separate local unit at the time of collection, either as a fixed amount per registration or a percentage of total receipts.

Although the total amount of motor-vehicle taxes granted for local road purposes may have no relation to traffic needs originating on these systems, in a large number of States registration fees are allocated among the separate units with a regard for relative traffic potentialities. Thus Arizona counties retain 50 cents for each original registration, while in Alabama 20 percent of total receipts from this source are used in the counties where the taxpayers reside. In the case of the gasoline tax, however, not only does the original sum granted by the State have little bearing upon traffic volume and intensity, but also the allocations among individual local units are generally based upon formulas which are untenable. Alabama, for example, distributes 3 cents of a 6-cent tax equally among its 67 counties, while New York counties receive 20 percent of collections according to the road mileage of each county. In Tennessee 1 cent of the gas tax is distributed to the counties equally, ½ cent on county areas, and ½ cent according to county populations.

STANDARDS NEEDED TO GOVERN ALLOCATION OF ROAD FUNDS

When money is distributed equally among local road units which vary in size and stage of development, or on the basis of land areas and road mileage which bear no relation to traffic conditions, there is little chance that distribution will be economically justifiable. Only by chance will highway income be in reasonable balance with the demand for funds. Even population and assessed valuation may be poor indices of the proper share of taxes required by local governments for transport facilities. Questionable practices of tax allocation accordingly help to make possible such variations in road expenditures as found in North Carolina before the State assumed control of all rural roads. The annual road expenditure in one county was $14 per mile, while in another it was $688. Similar conditions were found in Iowa in 1933 by a study of the Brookings Institution, which revealed that if State funds were distributed on the basis of some defensible index such as traffic or vehicle registrations (instead of area) allotments would have been reduced considerably in 75 percent of the counties.

In general the conclusion may be drawn that present methods of State fund allocations to local roads and streets are no less heterogeneous and unscientific than

[1] Presented at the Seventeenth Annual Meeting of the Highway Research Board, December 2, 1937.

[2] Details by States are given in the appendix, table A.

are the rates and bases of the taxes through which these funds are raised.

Economics of user tax distribution.—The question of what share of State motor-vehicle taxes should rightly be allocated to roads and streets other than on the primary system involves fundamental concepts of highway economics. The purpose of roadbuilding is to provide for adequate traffic facilities at the lowest possible cost, including both road costs and vehicle operating costs. In spending for the highway program, therefore, funds must be allocated to those parts of the transportation system where improvements will bring about the greatest reduction in total cost and the greatest utility in adequate service.

Since limited funds do not permit simultaneous betterment of all roads, the element of time is of great moment in an economic distribution of vehicle taxes. If funds were returned to local roads and streets in the amounts generated thereon, prior to adequate development of a system of main highways, the higher cost of transportation for the many vehicles on congested primary routes would far outbalance the reduction in operating costs on the local roads. Also, whereas two road systems may carry equal amounts of traffic, expressed in vehicle miles or gasoline tax receipts, yet the needs of either depend largely on the type and distribution of this travel: Whether highway utilization has been intensive, as on heavily trafficked main roads, or extensive, as the dispersed use of a large network of local rural roads. It must also be known in what ratio heavy trucks and busses or pleasure vehicles have accounted for traffic volumes. Furthermore it is important to recognize the integration of motor travel on the various road systems, and the fact that it is the entire trip which must be made at lowest cost, as well as the entire motoring population which must be considered in the computation of total costs for the entire highway system.

The aspect of the principal routes as revenue producers is sound in principle. So large a percentage of the actual use of these is recreational in character that the potential increase by reason of wholly adequate facilities should be self-evident—not only this, but the competitive nature of recreational offerings. The highways must compete with other classes of recreational inducements. In the business of tourist traffic one route becomes competitive with other routes, region with region, and even State with State. The impact of the degree of adequacy of major highways has large effects upon both private and public income. The financial support for local road improvements depends to great extent upon the excess earning capacity of the main roads, which in turn is dependent upon the attraction of potential traffic resulting from the offering of satisfactory facilities.

Broader understanding of the purpose of a highway transportation system, viewed as an entity, will demonstrate the importance of such concepts as priority and intensity of use, rather than integrated vehicle mileage alone, as standards by which tax allocations must be measured and financial policies adopted.

Trend in State tax distribution.—Of the total collections of State motor-vehicle taxes in 1927, 73.1 percent were used for State highway purposes and 22 percent for local roads and streets. By 1936 the percentage of user taxes spent on State roads had decreased to 55.2 percent, while local road allocations increased slightly to 25.1 percent. During this 10-year period, however, total vehicle taxes increased 90 percent, so that the reduced State highway share still represented a 4 percent dollar increase, and the 3.1 percent rise in the local road allotment was an actual 115 percent dollar increase. These figures are shown in table 1.

TABLE 1.—*Distribution of motor-vehicle taxes for highways, 1927 and 1936* [1]

Year	Total vehicle taxes collected	Amount for State highways	Percent	Amount for local roads and streets	Percent
1927	$560,027,983	$409,596,885	73.1	$123,176,360	22.0
1936	1,057,995,000	583,616,000	55.2	265,496,000	25.1
Percentage change 1927–36	+90	+42	−17.9	+115	+3.1

[1] Detailed tabulation appears in the appendix, table B.

It will be noted that whereas in 1927 vehicle funds available for highway purposes were 95.1 percent of the total, in 1936 only 80.3 percent of tax collections were used for highways. This increasing use of road funds for other purposes appears to have hit hardest the State highway systems, though hidden and unreported diversions by local units of government make impossible any definite statement on this subject.

CONTROL OF LOCAL ROADS BEING TRANSFERRED TO STATES

There has been more widespread recognition in the past decade of the right of subordinate units of government to share in State taxes. For whereas 20 States distributed gasoline taxes to local roads and streets in 1927, in 1936 there were 36 States making such allotments. Registration fees were used for local roads by 27 States in 1927 and by 32 States in 1936.

City streets.—Because funds allotted to counties in many States may be used within municipalities, and because such expenditures are not always reported separately, it has not been possible to determine accurately the amount of State money spent on city streets. Accordingly these sums have been included with local road apportionments, and expenditures on urban extensions of State systems have been included in State highway disbursements where it has been possible to segregate them from other local road and street funds. The best figure obtainable for State money spent on city streets is $31,468,000, compiled by the United States Bureau of Public Roads for 1936. Eleven States report such expenditures.

Administrative set-ups.—Highway administrative agencies in the United States include the States, counties, towns, and townships, incorporated cities and villages, and miscellaneous local divisions of government. In each State the size, type, and number of such agencies in operation, and the relation or lack of relation among them, differ widely.

In 4 States all rural roads are administered by the State highway departments, while 26 States [3] have State and County organizations; 6 have State and township systems; and 12 have three systems: State, county, and township. In addition to these rural systems, all States contain municipal organizations which have charge of urban streets, and half the States have further independent or semi-independent divisions within the county, such as commissioners' districts and special assessment districts, both rural and urban.

In most States there is neither control by the State over the spending of funds allocated to lesser govern-

[3] Including the State of Washington, although 2 of its counties still contain township units.

mental units, nor is there cooperation between the State and local highway organizations. Where laws designate that the State shall approve county construction programs financed with the assistance of State funds, such approval is not uniformly followed by adequate supervision of the actual work. Where counties are invited to seek the aid and advice of the State, in practice the results are far from reassuring.

Trend toward centralized administration.—At the close of 1930 there were 324,496 miles of highways under State control. By the end of 1936 State-controlled mileage had increased to 533,144 miles, a 64.3 percent addition in 6 years. Such has been the progress of a movement toward centralized highway administration which began in North Carolina in 1931. By assuming control over the State's 46,800 miles of county roads, North Carolina was the first to consolidate its entire rural highway system under the State highway department.

It was not long, however, before complete centralization was adopted in West Virginia, Virginia,[4] and Delaware. In Maryland 20 out of 23 counties have turned over their roads for maintenance by the State, while a program of consolidation under way in Pennsylvania has resulted in State participation in the maintenance of 46,000 miles of township secondary roads. On January 1, 1938, a total of 2,574 miles of Pennsylvania roads in townships, boroughs, and cities will be absorbed by the State. Popularity of the road consolidation program since 1931 may be judged by figures in table 2, which show highway transfers to the State highway departments.

Twenty-six separate transfers have been made in the 6-year period 1931–36, involving 21 States and nearly 172,000 miles. It is of interest that last year 10 States were involved in such transfers, or twice the number in any previous year.

TABLE 2.—*Transfers of local road mileage to the State highway departments* [1]

Year	Number of States	Mileage involved
1931	3	73,651
1932	1	37,028
1933	3	37,744
1934	5	7,190
1935	4	5,623
1936	10	10,696
Total	[2] 21	171,932

[1] A detailed tabulation appears in the appendix, table C.
[2] Several States effected more than 1 consolidation.

Further consolidations have been effected among the lesser units of government in the assumption of township road responsibilities by county highway organizations. It is generally conceded that the township, which in most cases contains an area of 36 square miles or less, has no place in efficient highway administration, and in the past 7 years four States have done away with these ineffective highway administrative agencies and adopted a so-called county-unit form of highway organization. With this type of administration all roads within the county and not a part of the State system are operated as a unit, with locally collected taxes in townships and districts being spent by the central county administration without regard to township or district lines. This county unit plan makes possible more economical use of road machinery, a broader tax basis, cooperation and planning, economy in maintenance operations, quantity purchasing, and necessitates the budgeting of funds and the keeping of cost records. When Michigan recently completed the transfer of 60,000 miles of township roads to county-unit control, there were eliminated 1,376 small administrative units.

[4] Except 3 counties which have elected to retain control of local roads.

STATE ADMINISTRATION OF ROADS MORE ECONOMICAL THAN LOCAL ADMINISTRATION

Causes of consolidations.—The immediate cause leading to centralization of road administration in North Carolina appears to have been the public desire, accentuated by economic depression, to escape from county property-tax levies. It was proposed that the State assume all future highway financial requirements, with the aid of a 1-cent increase in the State gasoline tax, except that the counties should continue payment for the servicing of highway obligations previously incurred. The shift of financial responsibility, then, was from property to motor vehicles and from local governments to the State.

This centralization plan, however, suggests something more than a temporary relief measure. For it is doubtful that the counties would have acceded to such surrender of autonomy had the past record of county highway administration proved efficient and economical. That such terms could not be applied to a majority of North Carolina counties was evident from the conditions which the State found in existence upon taking over local road affairs. Instead of 67,000 miles of roads listed by the counties only 45,000 miles could be found, despite the fact that 2,590 miles had not been accounted for in the original figure. Maintenance varied from satisfactory standards to hopeless inadequacy, and maintenance records in many counties did not exist. Some counties were found oversupplied with machinery, others practically destitute, and in nearly all cases machines were either obsolete or badly in need of repair. Such causes as these, rather than temporary tax relief, are thought to have been fundamental in the trend toward State assumption of local roads. That the trend has not slackened with return to more normal economic conditions may have a bearing upon this point.

Property taxes for roads.—Whatever is to be said for or against State centralization of highways, the concomitant policy of relieving property of its share in supporting the highway does not conform with the generally accepted theory of highway economics: That costs should be paid in accordance with service rendered. The shifting of road administration from local to State control involves no alteration in the principle that highways serve other functions than those directly relating to motor vehicles. In an equitable allocation of highway costs, rational payments for land service are rightly chargeable to the land which is served. Property levies are an essential part of highway income, and their elimination may not only deter a proper development of highway facilities, but may also constitute an unfair burden upon the motorist.

A second criticism of policy in connection with highway centralization concerns the tendency of the State to neglect its first responsibility of preserving the integrity of the primary road investment and of providing necessary extensions. A shift in administration does not relieve the State of obligations previously assumed, and the requirements of the main road system must be recognized prior to further tax allocations.

A large element of overriding the recommendations and warnings of the State highway departments has characterized the adoption of State policies throwing the cost burden of additional large mileages upon the incomes from user taxes available to the departments and usually inadequate for the requirements of the existing major highway systems.

Criticism of small administrative units.—It is self-apparent that many small roadbuilding entities now in operation are outworn relics of the dependence of transportation upon the horse: That both the time and distance of travel upon which their limits were fashioned have been reduced to negligible importance. Administrative scope has expanded, and this fact must be recognized by eliminating the multiplicity of highway organizations of minor units of government which make impossible the operation of highways as a coordinated system. A small unit is generally unable to afford proper engineering personnel, its staff may be subject to frequent changes because of elections, and in general undue emphasis is likely to be placed upon political rather than technical considerations.

Short radii of operation make the use of modern road machinery uneconomical through excessive overhead and numerous duplications, while small purchases of supplies and materials impose penalties of higher unit prices. Variations among the jurisdictions in area, population, taxable valuation, road mileage, topography, climate, vehicles registered, and traffic volumes, may make possible the extension of road facilities beyond traffic requirements in one county, while a neighboring unit may be financially unable to provide the taxpayer with a lasting return for the money he pays for satisfactory highway services. Budgeting, accounting, debt control, and planning are generally beyond the pale of local road administration; while lack of continuous maintenance, the use of force account methods, and incompetently controlled spending of funds collected outside the local jurisdiction are weaknesses generally in evidence.

OPTIMUM SIZE OF HIGHWAY ADMINISTRATIVE UNIT DISCUSSED

Variations among counties and States.—In most discussion relating to the merits or demerits of centralized government it is claimed on the one hand that the county is "too small" to effect a proper highway administration, and on the other that the State is "too large." Either statement implies that counties and States are essentially homogeneous, and that there exists a standard-size government unit most applicable to proper highway management. Yet neither counties nor States are homogeneous units. Counties may differ in area from the 25 square miles of Arlington County, Virginia, to San Bernardino's 20,175 square miles in California. This latter county is larger than the three States of New Jersey, Delaware, and Maryland combined.

In population, variations are even more pronounced, Loving County, California, for example, having but 195 residents compared with 4 million persons living in Cook County, Illinois. As regards the States, the largest area is 250 times that of the smallest, while populations vary in the ratio of 138 to 1. Nine States have more than 100,000 miles of highways (Texas has over 200,000) while six have less than 15,000. The fact that a county may be larger than the State of Delaware, in which State centralization of highways is in effect, presents the possibility that the State may actually be "too small" and the county "too large."

Consideration of the county as a highway administrative unit must take into account the two different general types of county, the rural, and the urban. It is the rural county which is so often unadapted to the performance of highway functions because of the limitations of its resources and the lack of sufficient highway activity to permit large-scale operations, either intensive or extensive. The urban county which contains a large city and considerable traffic and population, however, is, by reason of its wealth, responsibilities, and intensive road needs, a logical highway administrative unit. Such urban counties nevertheless are handicapped in their function of improving highways by reason of the fact that they are usually part of a larger metropolitan area embracing more than one county, as well as lesser jurisdictions such as towns and villages. Definite legislation is accordingly needed for effectuating correlated action throughout the metropolitan district, both in planning the transportation system as a whole and in detail, and in fixing priorities for the improvement program. It is necessary, therefore, to distinguish between such counties, and to recognize that to speak merely of the size of an administrative unit may be inconsequential, if not misleading.

Since such special considerations must be taken into account, it seems obvious that no definite standard-size unit can be prescribed which will be a universal absolute for highway administration. The intensity of highway needs varies, as well as the degree to which a region has been developed and the type of its development. Large agricultural regions might prove nearer the optimum unit for highway administration than large areas of concentrated industrial development. Physical characteristics such as topography and climate are important factors for consideration as well as possible sources of highway funds and probable necessary amounts of expenditures.

The optimum size of highway units.—Certain characteristics of local government mentioned are susceptible to correction, such as lack of planning, budgeting, and other administrative matters. It is claimed by the opponents of centralization that county government may be revived by effecting reform along these lines. But many criticisms against the local highway unit as an administrative body are functions of physical characteristics which are not susceptible to "reform." No matter how efficient its system of accounting nor how expert its highway commission, local government may still be limited to uneconomical operations unless it is able to raise sufficient funds to pay the highway bill and unless the scope of construction and maintenance requirements will allow fullest utilization of equipment, a proper distribution of overhead, and the economical operation of a competent engineering organization.

The economist recognizes that a profitable industrial plant is limited in its physical equipment to an optimum unit of operation: That unwieldy production units cause economies of large-scale production to give way to dis-economies, and that particular circumstances may alter the optimum plant even in the case of similar products. On the other hand, horizontal combination of a number of optimum production units under centralized administration is entirely in keeping with economical operation. The so-called American trust is an example of such horizontal combines. In other words an industry may require technical decentralization and managerial centralization.

This principle of economics appears to be applicable to the provision of highway facilities, in which optimum highway operating units might be determined upon, and their management directed centrally. Such is the general plan adhered to in the division of State highway systems into engineering districts, and suggested in the relation existing between the Federal and State governments.

It does not appear unworkable that all rural roads in a State might be operated on a similar basis. Each State might contain several highway operating units varying as to optimum sizes in accordance with particular considerations. These districts might be a grouping of counties or other local jurisdictions into regional areas. In small States or States essentially agricultural the entire area might be determined the optimum, in which case consolidation of all roads in the State would be economically in order. Whatever the size and number of operating units, however, financial and planning administration might still be centered in the State.

DATA BEING OBTAINED TO ENABLE PLANNING OF FUTURE HIGHWAY PROGRAMS

The establishment of the State highway departments was recognition of the need of centralized administration in creating a primary system of roads, and in the spending of State vehicle taxes with wisdom and coordination for the best interests of the whole State. Local units of government on the other hand were left to administer their individual highway affairs, which were truly local affairs financed by local money. With the State-wide extension of motor transport, however, all roads within a State developed into a network which it was necessary to view as a whole. Recognition of the wider influence of secondary roads was granted in the form of allocations of State money to local units of government which were not established to be expending agencies for such funds. Accordingly, the principle came to be tolerated that there should be centralization of certain highways in the State, financed by State funds, and decentralization of certain other roads, also financed with State taxes, in a multiplicity of lesser governmental units. There is basic conflict between these two policies. On the one hand it is accepted that the highways constitute a closely-knit system; on the other hand uncorrelated policies of finance develop them as a patchwork.

The chief objections to State control of all highways are for the most part political rather than economic. That is, there is general recognition of the possibilities of economy and a coordination with control centered in the State highway department, but there is fear concerning the effect on local government which might result from eliminating local highway administration. Such action, it is asserted, would tend to discourage interest in other local governmental functions and eventually to bring about complete State centralization. This would be the first step, according to stock arguments, toward the destruction of self-government, individual initiative, and democracy.

The "fine-woven rhetorical expressions" advanced in behalf of local government, it is pointed out, must be tempered with the common-sense observation that highway transportation is not a function properly confined to imaginary and outmoded political boundaries. To claim that the preservation of democracy depends upon the maintenance of such a system has been construed by some as an argument for governmental waste and inefficiency; and to extol the small local unit as a "school for democracy" has been challenged on the grounds that accounting and engineering are so often omitted from its course of study. The statement has been made that if democracy can coexist with such philosophies of government there is little fear that it would perish from State financial administration of highways.

Factors supporting centralization trend.—A consideration of importance with regard to the future possibilities of centralized highway administration is the recently inaugurated Federal assistance for secondary road development. During the depression years secondary roads and urban streets were granted various emergency appropriations by the Federal Government for the prime purpose of furthering employment. In the present fiscal year, however, regular Federal-aid grants of $25,000,000 are available for secondary road improvement, to be matched by equal amounts of State funds. It is of significance that the State highway departments may employ the services of competent county highway organizations acting under direction of the State, in the preparation of plans, surveys, and specifications, and in the supervision of construction. Where laws limit the State highway department in the extent of mileage it can maintain, the State may draw up agreements with lesser governmental units which will attend to the maintenance of these secondary roads. No such agreement will be approved, however, if any road previously built with Federal funds and currently maintained by a county or lesser political unit is not being kept in satisfactory condition.

Centralization and planning.—A further development toward closer cooperation between State and county, and greater control by the State over local roads is the promising possibility of State-wide highway planning. Surveys now under way to provide the facts necessary for plans may be made the instrument for publicizing the inadequacies of small highway units, and for revealing to the taxpayer how much of his money supports obsolete governmental machinery instead of better roads. It is also hoped that State legislation may follow the findings of such surveys when questions of highway administrative reform arise.

Some of the immediate purposes of the State-wide planning surveys are included in the following:

1. To define the mileage of roads within each State to be supported by public funds.
2. To determine the use made of the parts of this system, hence the sources of necessary taxes and their proper distribution.
3. To determine future construction requirements for extensions, improvements, and replacements.
4. To determine the priority of such construction projects.
5. To estimate necessary maintenance operations.
6. To estimate future highway income and to budget this sum according to estimated future financial requirements.

These several purposes emphasize the need for control by a central agency to supersede uncoordinated plans which result from the operation of a large number of highway jurisdictions acting independently. In order that planning may be effective throughout the State there must be an administrative control with greater power than any of the separate minor units. Planning which is "State wide" cannot be attained by a number of individual plans within the State, but only by a central plan which applies to an integrated system.

In review of the foregoing status and trends in State vehicle tax distribution for highways and in highway administrative procedure, a summary of the data is presented, followed by a list of conclusions and recommendations suggested by them.

1. Approximately one-fourth of all State motor-vehicle taxes were distributed for local road and street purposes in 1936.

2. The share of State funds allocated to local roads and streets has increased only 3.1 percent in the last 10 years, while the actual money so distributed shows a 115 percent dollar increase during the same period.

3. The State highway share of motor-vehicle taxes has decreased more than 17 percent in 10 years, while the dollar allotment has increased 42 percent.

4. State funds are distributed to local units of government in widely varying amounts and without regard to traffic generated, five States making no allocations and one distributing more than 24 million dollars.

5. Methods of distribution among each separate local unit are generally untenable, being made in equal amounts or on the basis of area, population, road mileage, assessed valuation, vehicle registrations, tax collections, or a combination of two or three of these.

6. In most cases the States retain no control, or merely nominal control, over the spending of vehicle taxes used on local roads and streets.

7. Four States have consolidated all rural roads in the State highway departments, while 26 States have State and county organizations, 6 have State and township units, and 12 have three systems: State, county, and township.

8. In the past 6 years 21 States have shifted 171,932 miles of local roads to State control, constituting a 64.3 percent increase in State mileage during that period.

9. More States were involved in local road consolidations in 1936 than in any previous year.

10. In the past 7 years 4 States have eliminated all township road units.

11. The highway consolidation movement has shifted the highway tax from local to State government and from property to motor vehicles.

RECOMMENDATIONS AND CONCLUSIONS

1. Allocation of State vehicle taxes to local roads and streets should be made with reference to both volume and intensity of traffic generated, but with consideration for the priority of primary road requirements so that transportation facilities for the integrated system may be adequate and at lowest total cost.

2. The State should maintain adequate control over all projects on which State money is used.

3. Arbitrary political boundaries have no relation to functions of highway transport.

4. A highway operating unit may be limited in its ability to function economically by reason of certain characteristics inherent in small-scale operations.

5. A highway administrative area is not necessarily limited to the optimum unit determined upon for construction and maintenance operations, and should embrace sufficient area to permit quantity purchasing, specialized personnel, and a coordinated highway program.

6. With the transfer of local roads to State control, benefits to land remain a legitimate highway service which should be recognized by property contributions to the highway fund.

7. It is important that the State should provide first for all primary road obligations before assuming added burdens in connection with local roads.

8. Federal aid for secondary roads is recognition of the fact that such parts of the highway system are of more than local service. This new Federal policy promises to create closer cooperation between States and local units.

9. State-wide planning surveys constitute the first wholesale attempt to bring before the public and legislative bodies facts concerning the need for sane financial and administrative policies.

10. State-wide plans cannot be successful without a central planning authority.

11. The failure of any State to provide a major system of highways not only adequate but attractive to the rapidly growing tourist and recreational traffic results in large losses of potential income to the public from the user taxes and to private business relying upon the highway travel.

The failure to establish and to follow sound principles of financial administration is a serious cause of lack of progress toward adequate major highways where this condition exists.

12. The waste of highway funds by duplicate local units and the uneconomical operations they necessitate brands financial administration the least progressive field of highway transportation.

SUMMARY

Last year approximately a quarter of a billion dollars, or one-fourth of total State motor-vehicle collections, was distributed for local road and street purposes.

Study of the past 10-year trend in this allocation of State funds reveals that the 1936 allotment was more than double the amount distributed to local jurisdictions in 1927. The percentage of total collections so distributed, however, has increased during that period by only 3 percent.

The amount of State funds spent on State roads has also increased in this 10-year period, but the increase has been only 42 percent as compared with the 115 percent increase in local road apportionments. Moreover, there has been an actual decrease of 17 percent in the share of total State taxes so used. This discrepancy appears to be a result of a wholesale use of funds for other-than-highway purposes.

The amounts of user taxes going to local units of government vary widely from State to State, as do the methods upon which such distribution is based. In 1936 five States made no allocations to local roads, while one State distributed two-thirds of all motor-vehicle receipts. Distribution among the local units was found to be based on a variety of criteria, including population, area, vehicle registrations, valuation, tax collections, road mileage, and combinations of these factors. In some States these funds are distributed equally among the local governments.

It has been found that these methods of local road allocations often fail to reflect properly the needs of the highway system as a whole. For an economic distribution of funds requires that money be spent according to the needs of traffic, expressed in terms of the lowest possible total cost of transportation, which includes not only road costs but vehicle operating costs. In other words it is not merely total traffic which must be considered, but the concentration of

this traffic: The intensive as well as the extensive use made of the highway system. Moreover, since all needed improvements cannot be made simultaneously, funds must be spent according to a priority which will permit the largest reduction of total transportation costs to be made first. In determining this priority it should be remembered that because of the integration of traffic on several road systems, it is advisable to improve the primary system first, since it carries the largest amount of concentrated traffic and its improvement brings about increased travel and increased receipts for the support of local roads.

It has been found that the spending of State funds by local governments is not always to best advantage because it is not properly controlled by the State. In addition, a complexity of lesser units of government discourages broad improvement programs, coordination, and long-range planning. Many local units do not comprise sufficient taxable wealth and highway activities to qualify them as logical highway administrative agencies.

In the search for the proper scope for highway activities it is concluded that there may be a distinction between the highway administrative unit and the economic operating unit: That the former may comprise several of the latter. This principle is recognized to some extent in the relation between the Bureau of Public Roads and the State highway departments, as well as in the division of a State into State highway districts.

Operating units which do not have sufficient taxable wealth and traffic may require consolidation before they are able to perform their functions economically. Among other things there must be sufficient road work to allow efficient utilization of equipment, and sufficient appropriations to permit a competent engineering force.

Two types of counties are recognized: Rural and urban. Rural county highway units may comprise large areas for economic highway operations; while the urban county, because of its wealth, population, and traffic, may properly be confined to a small area. Because the urban county is usually part of a larger metropolitan area containing other counties, as well as towns and villages, immediate legislation is needed for effectuating correlated action, both in planning the transportation system of the region as a whole and in detail, and in fixing priorities for improvement programs.

Correction of the weaknesses of highway administrative finance, when left to the discretion of a large number of local governments, has been attempted by consolidation of road units, particularly by the transfer of local roads to State control. In the past 6 years 21 States have taken over 172,000 miles of local roads, constituting a 64-percent increase in State mileage during that period. Four States have eliminated all locally administered rural highways. As regards the other administrative set-ups, 26 States have State and county organizations, 6 have State and township units, and 12 have three systems: State, county, and township.

Transfers of local roads to State control have brought about a shift of the road burden from land to motor vehicles and from local government to the State.

Although the road-consolidation movement was precipitated by the recent economic depression, as a means of relieving property of the road-tax burden, it appears that the inherent failings of incompetent local governments have been underlying causes of the movement. For in 1936, 10 States effected local road transfers to their State highway departments, a larger number than in any previous year.

It is felt that the policy of Federal-aid appropriations for secondary roads, as well as the trend toward highway planning, will in many cases accentuate the movement for State administration of rural roads.

APPENDIX

TABLE A.—*Legal provisions regulating the use of State motor-vehicle funds for local roads and streets* [1]

GASOLINE TAXES

State	Tax rate	Distribution to local roads and city streets
	Cents	
Alabama	6	3 cents to counties, distributed equally.
Arizona	5	3/10 to counties, according to gasoline sales in each.
Arkansas	6.5	7.7 percent to counties, on basis of population, registration, and area.
California	3	½ to counties; $5,000 for each county and county-city, 4 times per year; balance distributed according to registrations.
Colorado	4	27 percent to counties, 3 percent for extensions of State system in cities, towns, and counties; on basis of State mileage in counties.
Connecticut	3	
Delaware	4	
Florida	7	3 cents to counties, distributed among them by particular statutes.
Georgia	6	1 cent to counties on basis of State-aid mileage in each.
Idaho	5	
Illinois	5	½ to counties, ½ to municipalities, on basis of vehicles registered.
Indiana	4	40 percent to counties, 10 percent to cities; according to population.
Iowa	3	⅔ to counties, by area.
Kansas	3	
Kentucky	5	
Louisiana	5	
Maine	4	To general highway fund, with registration fees, from which $150,000 goes to town roads, $700,000 to third class roads, on mileage basis, and $1,000,000 to State-aid roads according to town valuation.
Maryland	4	1.05 cents to counties, by mileage of county roads; 1.15 cents to Baltimore city.
Massachusetts	3	
Michigan	3	To State highway fund, with registration fees, from which $6,000,000 goes to counties, ⅞ in proportion to fees collected, ⅛ equally.
Minnesota	3	½ to counties, based on mileage and traffic needs.
Mississippi	6	2½ cents to counties, on basis of population, registrations, and area.
Missouri	2	
Montana	5	
Nebraska	4	⅜ to counties.
Nevada	4	
New Hampshire	4	Small amount to some local roads (less than 9 percent of total in 1936).
New Jersey	3	$5,000,000 to city streets.
New Mexico	5	
New York	3	5 percent to New York City; 20 percent to counties, by mileage.
North Carolina	6	
North Dakota	3	½ to counties on basis of registration fees collected.
Ohio	4	3 cents, minus about $285,000, to counties, villages, and townships on basis of vehicles registered.
Oklahoma	4	¼ to counties, according to population and area.
Oregon	5	
Pennsylvania	4	½ cent to counties, based on gas-tax returns during preceding 3 years.
Rhode Island	2	
South Carolina	6	1 cent to counties, based on registrations.
South Dakota	4	
Tennessee	7	To counties: 1 cent equally, ½ cent by population, and ½ cent by area.
Texas	4	
Utah	4	
Vermont	4	$500,000 to local roads, by mileage.
Virginia	5	$239,000 in 1936 for the 3 counties not under State control.
Washington	5	3 cents to counties and cities, according to gas sales.
West Virginia	4	
Wisconsin	4	
Wyoming	4	25 percent to counties; based 30 percent on area, 30 percent on rural population, and 40 percent on assessed valuation.

REGISTRATION FEES

Alabama	20 percent to incorporated municipality or county where owner resides.
Arizona	50 cents of original fee retained by county.
Arkansas	
California	Approximately 30 percent to counties in proportion to registrations.
Colorado	50 percent to counties in proportion to collections.
Connecticut	
Delaware	
Florida	
Georgia	

[1] Data incomplete.

TABLE A.—*Legal provisions regulating the use of State motor-vehicle funds for local roads and streets*—Continued

REGISTRATION FEES—Continued

State	Tax rate	Distribution to local roads and city streets
Idaho		90 percent retained by counties.
Illinois		
Indiana		¼ to counties and cities; counties, ⅞ on mileage, ⅛ on population; cities, on basis of population.
Iowa		
Kansas		10 cents of each registration to county.
Kentucky		
Louisiana		
Maine		
Maryland		After debt service and operating expenses of motor-vehicle department, traffic court, etc., 30 percent to Baltimore.
Massachusetts		
Michigan		See gas-tax data.
Minnesota		
Mississippi		All to counties where collected.
Missouri		
Montana		All to counties where collected.
Nebraska		5 cents retained by counties for each original registration.
Nevada		
New Hampshire		Small sum for State-aid ($272,000 in 1936).
New Jersey		Carrier taxes to municipalities.
New Mexico		15 percent to counties in proportion to registrations.
New York		25 percent to counties.
North Carolina		
North Dakota		
Ohio		47 percent to counties where car registered.
Oklahoma		9 percent to cities, 51 percent to counties.
Oregon		
Pennsylvania		
Rhode Island		
South Carolina		
South Dakota		76½ percent to counties where collected.
Tennessee		
Texas		100 percent to county where collected, up to $50,000; 50 percent up to $175,000.
Utah		
Vermont		
Virginia		
Washington		
West Virginia		
Wisconsin		20 percent retained by town, village, and city; also $3,000,000 to counties for State-aid roads, 40 percent on basis of registrations and 60 percent by mileage.
Wyoming		County registration fees retained.

TABLE B.—*Disposition of State motor-vehicle receipts to State highways and local roads and streets, 1927–36*

REGISTRATION FEES

Year	Total funds distributed	For State highway purposes	Percent	For local roads and streets	Percent	Total fund to State highways, local roads, and streets	Percent
1927	$301,061,132	$220,645,359	73.3	$61,543,245	20.4	$282,188,604	93.7
1928	322,630,025	235,142,906	72.9	66,569,311	20.6	301,712,217	93.5
1929	347,843,543	250,704,624	72.1	73,226,339	21.1	323,930,963	93.2
1930	355,704,860	253,013,603	71.1	74,639,463	21.0	327,653,066	92.1
1931	344,337,654	234,593,379	68.1	79,388,101	23.1	313,981,480	91.2
1932	324,273,510	188,539,140	58.1	83,298,207	25.7	271,837,347	83.8
1933	301,315,447	157,754,844	52.4	75,943,682	25.2	233,698,526	77.6
1934	318,576,965	175,382,722	55.1	84,356,966	26.5	259,739,688	81.6
1935	324,855,135	173,477,594	53.4	87,587,250	27.0	261,064,844	80.4
1936	374,921,000	194,491,000	51.9	98,241,000	26.2	292,732,000	78.1
Total	3,315,519,271	2,083,745,171	62.8	784,793,564	23.7	2,868,538,735	86.5

GASOLINE TAXES

1927	$258,966,851	$188,951,526	73.0	$61,633,115	23.8	$250,584,641	96.8
1928	305,233,842	225,315,715	73.8	68,562,491	22.5	293,878,206	96.3
1929	431,636,454	318,087,598	73.7	101,961,887	23.6	420,049,485	97.3
1930	494,683,410	359,797,465	72.7	118,247,702	23.9	478,045,167	96.6
1931	537,589,717	381,711,610	71.0	134,318,053	25.0	516,029,663	96.0
1932	514,138,900	336,144,197	65.4	127,220,400	24.7	463,364,597	90.1
1933	519,403,450	314,432,266	60.5	153,777,094	29.6	468,209,360	90.1
1934	565,139,596	333,196,930	59.0	138,338,782	24.5	471,535,712	83.5
1935	615,580,975	348,651,966	56.6	150,546,567	24.5	499,198,533	81.1
1936	683,074,000	389,125,000	57.0	167,255,000	24.5	556,380,000	81.5
Total	4,925,447,195	3,195,414,273	64.9	1,221,861,091	24.8	4,417,275,364	89.7

TOTAL MOTOR-VEHICLE TAXES

1927	$560,027,983	$409,596,885	73.1	$123,176,360	22.0	$532,773,245	95.1
1928	627,863,867	460,458,621	73.3	135,131,802	21.5	595,590,423	94.8
1929	779,479,997	568,792,222	73.0	175,188,226	22.5	743,980,448	95.5
1930	850,388,270	612,811,068	72.1	192,887,165	22.7	805,698,233	94.8
1931	881,927,371	616,304,989	69.9	213,706,154	24.2	830,011,143	94.1
1932	838,412,410	524,683,337	62.6	210,518,607	25.1	735,201,944	87.7
1933	820,718,897	472,187,110	57.5	229,720,776	28.0	701,907,886	85.5
1934	883,716,561	508,579,652	57.5	222,695,748	25.2	731,275,400	82.7
1935	940,436,110	522,129,560	55.5	238,133,817	25.3	760,263,377	80.8
1936	1,057,995,000	583,616,000	55.2	265,496,000	25.1	849,112,000	80.3
Total	8,240,966,466	5,279,159,444	64.1	2,006,654,655	24.3	7,285,814,099	88.4

TABLE C.—*Road consolidations*

Year	State	Local road mileage transferred to State	Year	State	Local road mileage transferred to State
1931	North Carolina	46,826	1935	Delaware	2,602
	Pennsylvania	20,167		Nebraska	1,391
	Louisiana	6,658		Missouri	834
	Total	73,651		Nevada	796
1932	Virginia	37,028		Total	5,623
1933	West Virginia	29,098	1936	Arizona	428
	Oregon	2,646		Georgia	648
	California	6,600		Kentucky	340
	Total	37,744		New Mexico	2,021
1934	Minnesota	4,356		Ohio	2,391
	Missouri	937		Oklahoma	606
	Georgia	367		South Carolina	419
	Indiana	871		Texas	579
	Kentucky	659		Missouri	914
	Total	7,190		Pennsylvania	2,350
				Total	10,696
			1927–36	Total transfers	171,932

SNOW REMOVAL AND ICE TREATMENT ON RURAL HIGHWAYS

Reported by H. A. RADZIKOWSKI, Associate Highway Engineer, Division of Construction, Bureau of Public Roads

MODERN HIGHWAYS ARE DESIGNED SO AS TO MINIMIZE THE AMOUNT OF SNOW-REMOVAL WORK NEEDED TO KEEP THEM OPEN TO TRAFFIC.

IN ORDER THAT the large volumes of traffic using their main highways can be served with facility and safety during the winter, all of the northern and western States annually spend substantial sums for snow removal and ice treatment. Operations during the winter 1936–37, the latest for which data are available, indicate the importance of this duty of the State highway-maintenance forces.

Data compiled from reports by 36 States show that they spent $17,099,626 to free 217,243 miles of main highways from ice and snow during the winter 1936–37. These data, given by States in table 1, show that the major equipment used in this work was as follows:

Equipment:	*Number*
Trucks	13,634
Tractors	1,316
Graders	2,505
Plows for trucks:	
Displacement type	12,784
Rotor type	209
Plows for tractors:	
Displacement type	1,029
Rotor type	107
Power shovels	41

In addition to actual removal of snow, the States erected a total of 12,040 miles of snow fence to prevent snow from drifting onto the highways. In each of 7 States the mileage of roads cleared of snow exceeded 10,000 miles; in each of 5 States the cost of snow removal and ice treatment exceeded $1,000,000.

Average snowfall figures for each State, reported by the United States Weather Bureau, are shown in table 1. These data are average figures for the entire State, compiled from records at stations located in various parts of the State. The average snowfall during the 1936–37 season was less than that during the previous winter in 25 States and greater in 10 States. In 8 States in the snow area the average snowfall was less than 20 inches during 1936–37, and in 10 States it exceeded 60 inches.

Average snowfall figures, however, cannot be accepted as a true index of the extent of the snow removal problem. Snowfall in mountainous regions may greatly exceed the average reported for the State. In one State the snowfall was reported as 469 inches on a mountain pass kept open during the winter season. High winds may blow snow over cleared roads, making additional removal work necessary. A small amount of precipitation, in the form of sleet, may necessitate considerable ice-treatment work.

Although the primary purpose of snow removal is to enable traffic to move with facility and safety, prompt

TABLE 1.—*Snow-removal and ice-treatment data for the winter of 1936–37*

State	Snow removal and ice treatment supervised by—	Comparative average seasonal snowfall from records in different sections of State [1]		Snow-removal equipment [2]							Mileage of snow fence	Mileage of roads cleared of snow	Total cost of snow removal and ice treatment	Remarks
				Plows for trucks		Plows for tractors		Trucks	Tractors	Graders				
		1935–36 season	1936–37 season	Displacement type	Rotor type	Displacement type	Rotor type							
North Atlantic States:		*Inches*	*Inches*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Miles*	*Miles*	*Dollars*	
Connecticut	State	45.5	21.3	343				343			29	2,700	302,900	
Maine	do	99.3	63.0	286	1	44	1	287	45		184	2,433	372,880	
Massachusetts	do	45.7	22.0	819		23		851	23		54	1,762	588,561	
New Hampshire	do	91.8	71.2	234	1	3		242	3		148	2,556	561,094	Chlorides, $36,656; plowing, $144,346; sanding $347,264; and snow fence, $32,828.
New Jersey	do	32.0	12.2	450	6	3	4	456	7	102	91	1,572	220,398	2 snow loaders a'so used.
New York	State and counties.	69.5	59.5	1,489	19	240	17	1,552	224	79	1,167	12,077	1,642,393	$808,488 expended by counties for snow removal; $833,905 expended by State for sanding; 56 of 57 counties on State highway system reported.
Pennsylvania	State	56.4	29.0	1,232	18	83	24	1,250	107	239	1,906	16,729	2,707,555	
Rhode Island	do	24.7	10.2	110			10	110	10		15	762	58,730	$12,882 for snow removal; $45,848 for ice sanding.
Vermont	do	68.9	63.3	120		5		120	5	3	112	1,759	327,585	
South Atlantic States:														
Delaware	do	34.1	8.9	130		3	1	116	4	5	23	2,500	14,369	
Maryland	do	43.2	23.8	249	11	4	3	437	74	45	130	3,955	99,131	
Virginia	do	33.4	14.1	508	2	74		510	74	44	8	9,225	31,327	Data refer to primary State system.
West Virginia	do	66.5	27.2	229		14		353	16	34	37	4,565	74,808	Some evergreen trees planted along the roadside for snowdrift control.
North Central States:														
Illinois	do	28.2	14.0	827	1			827			250	12,638	511,740	
Indiana	do	25.7	18.4	504	2	4		506	4		11	8,848	156,253	
Iowa	do	50.9	31.1	663	13	7	3	620	10	280	1,481	8,902	1,107,863	
Kansas	do	10.8	16.2	167		39		167	39	140	480	7,631	125,316	
Michigan	do	62.7	38.0	385	6	8	17	445	25		714	9,226	869,044	Some evergreen trees were planted along the roadside for snowdrift control.
Minnesota	do	57.3	69.0	432	23	22	10	364	5		1,161	11,195	1,603,323	
Missouri	do	15.1	14.2	270	2	1		500	1	50	244	13,750	310,367	
Nebraska	do	35.7	26.6	135	4	16		139	50	337	737	8,160	184,087	
North Dakota	do	39.0	36.3	25	7	1		25	1	25	575	5,000	242,848	
Ohio	do	41.0	21.1	669	6	10		675	10	35	106	14,000	575,000	
South Dakota	do	43.9	46.8	47		35	1	47	39	140	281	5,687	610,000	
Wisconsin	do	61.0	43.8	923	8	228		967	270	406	1,169	10,023	1,118,495	About 8 miles of hedge planted for snowdrift control; 21 power shovels also used.
Western States:														
Arizona	do	6.6	20.4	24	2	1	5	31	11	30	6	1,000	44,618	
California	do	(3)	(3)	130	17	21	1	138	25	50	17	5,263	604,768	Ice-sanding operations covered approximately 1,500 miles of the State highway system.
Colorado	do	68.2	72.1	224	9	55		305	132	209	68	3,593	152,863	5 power shovels also used.
Idaho	do	82.1	75.3	167	5	7	3	169	10	30	196	3,557	355,126	2 power shovels also used.
Montana	do	53.2	51.5	144	11	4		155	4	10	271	4,623	157,000	
Nevada	do	42.9	52.7	74	8	1	4	82	5		19	2,575	127,900	2 power shovels also used.
New Mexico	do	26.1	28.0	2		6	1	17		46	3	1,045	29,098	
Oregon	do	43.3	61.2	223	9		2	232	2	15	40	6,345	307,632	1 power shovel also used.
Utah	do	64.0	76.7	156		52		164	52	34	135	4,573	409,318	Do.
Washington	do	54.7	69.9	259	16	3		275	3	20	41	3,471	371,380	3 power shovels also used.
Wyoming	do	78.4	67.3	135	2	12		157	26	97	131	3,543	123,856	6 power shovels also used.
Total				12,784	209	1,029	107	13,634	1,316	2,505	12,040	217,243	17,099,626	

[1] Snowfall figures compiled from U. S. Weather Bureau records.

[2] The number of displacement plows, rotary plows, etc., listed includes equipment reported as under the control of various States and counties, but does not include equipment owned by numerous other counties for which no data have been submitted or by townships, municipalities, transportation companies, and diverse business agencies.

[3] Not available.

removal also helps to preserve the road surface and shoulders.

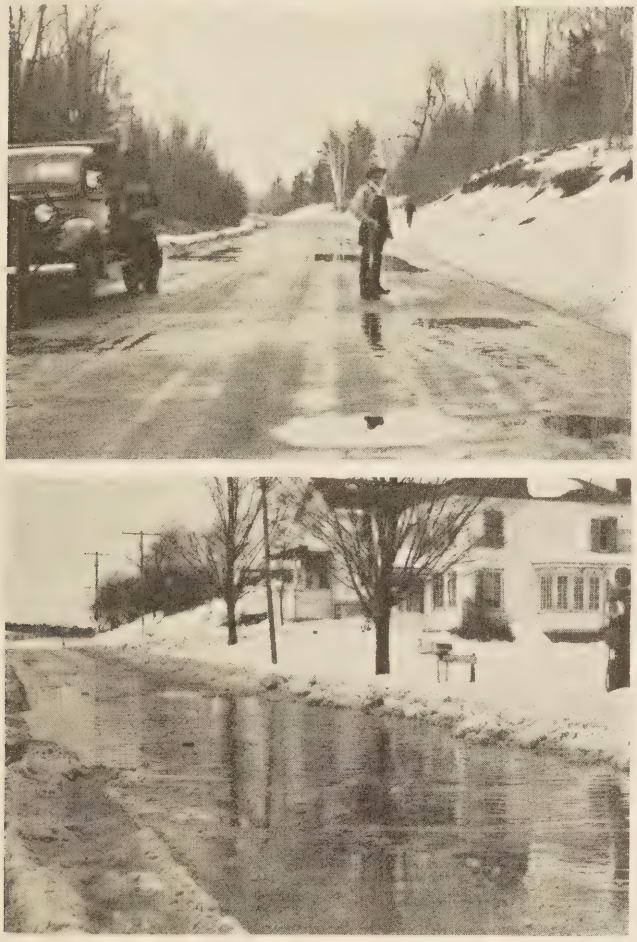
The snow should be pushed back from the shoulders to facilitate the flow of water from melting snow into drainage channels. Failure to remove snow from the shoulders, and allowing a thin cover of snow or ice to remain on the surface, results in erosion on low- and intermediate-type surfaces and loss of supporting value. The water from thawing snow and ice frequently runs along the edge of the pavement, softening the shoulders and allowing seepage under the pavement and into the subgrade. This excess water may serve to build up ice layers with resulting frost heave, and often cannot drain away through the ground because of an impervious layer of frozen soil below. The weakened road may quickly fail under traffic, especially at the edges of flexibile-type surfaces. It is now generally recognized that it is less expensive maintenance for snow-removal crews to preserve the road by draining the traveled way during each thaw than to repair winter-damaged surfaces and shoulders.

HIGHWAYS ARE DESIGNED TO PREVENT SNOW BLOCKADES

The problem of keeping the highways cleared of snow can be partly solved by using all practical means of preventing the snow from collecting on the roadway. Such preventive steps may include the erection of snow sheds, the planting of trees, erection of snow fences to control snowdrifts, and the design of the highway itself.

Highways in the northern and western States are located and designed with a view to minimizing the

snow removal problem. The practice of locating the highway to take advantage of the prevailing wind is recognized. Road grades are raised above the adjacent ground level to provide wind-swept surfaces; slopes are flattened to reduce obstruction to wind-sweeping action; and ditches are widened to afford better drainage and greater snow-storage capacity. When funds permit, maintenance crews sometimes flatten and round through or side-hill cuts to create sections that induce air flow.



IMPROPER DRAINAGE DURING THE WINTER MAY CAUSE DAMAGE TO THE ROAD AND CREATE A SERIOUS HAZARD TO TRAFFIC.

Snow fences are used in areas where the topography is conducive to the formation of snowdrifts on highways. The purpose of these barriers is to cause the deposit of snow before reaching the road by retarding the velocity of snow-carrying winds. Location and placement of the fence, both temporary and permanent, are largely governed by the maintenance superintendents, who know where drifting has occurred in previous years. The portable picket-type of snow fence is most generally used (11,830 miles in 1936–37). This type of fence consists of wooden slats 4 feet high, 1½ inches wide, and ½ inch thick, woven together with galvanized wire and spaced 2 inches apart. The fence is secured to angle-bar posts on the windward side of the road a sufficient distance beyond the outside edge of the ditch to prevent the toe of the drift from covering the drainage channel. This type of fence is generally erected in the fall and removed in the spring. Trees and shrubs are sometimes planted as snow barriers where sufficient right-of-way is available. Brush and other obstacles that might cause snow to drift across the roadway are removed to allow free wind action.

SNOW SHEDS ARE THE MOST PRACTICAL MEANS OF KEEPING ROADS OPEN IN CERTAIN AREAS WHERE SLIDES OCCUR.

Several different types of snowplows are used to remove snow from the highway. For light work graders and light blade-type displacement plows are adequate. V-type and side-wing displacement plows are suitable for moderately heavy work. For extremely heavy work rotor-type plows are generally used. As shown by table 1, the displacement-type plow pushed by trucks was the most widely used type during the 1936–37 season.

Light V-shaped and blade displacement plows are often used to open the traveled way for traffic, followed by rotary units which blow the snow clear of the roadway. Rotary plows and heavy tractor-propelled V-plows are used extensively in deep drifts on mountain passes. Use is also made of side-wing plows and slice bars for cutting down snow banks in deep drifts.

MOTOR GRADERS ARE OFTEN USED FOR LIGHT SNOW-REMOVAL WORK.

The clearing of mountain passes has been undertaken quite extensively by the various western States. The work usually requires the most powerful type of equipment to cope with the heavy snowfall, steep grades, high altitudes, and wind and slides. The auger blower rotary plow and the V-plows with rotary attachments for relieving the snow pressure on the face of the V are frequently used for this work. The rotors are generally driven by auxiliary power units carried on the rear end of the truck or by the tractor power unit

DISPLACEMENT-TYPE PLOWS PUSHED BY TRUCKS ARE MOST WIDELY USED FOR SNOW REMOVAL.

which pushes the plow, depending on the type of motive force used. The rotors discharge the snow upward by centrifugal force. Deflecting chutes direct the discharge to either side, taking advantage of the direction of the wind. The snow is cast clear over the side banks, the distance it is thrown depending on the speed of the rotors and the force of the wind. In a few places where snow slides occur frequently snow sheds are the only practical means of keeping the roads open.

Efforts are made to prevent damage to guardrail and sign posts by snow equipment, by marking guardrails with high markers visible when the snow is deep, and by careful operation of equipment.

In 35 of the States reporting, the State highway departments controlled snow-removal work on State highways. In New York the counties performed snow-removal work, and the State did ice-treatment work on State highways. The States generally store snow-removal equipment at maintenance depots located at strategic points on the highway systems.

V-TYPE SNOW PLOW SUITABLE FOR MODERATELY HEAVY WORK

In the State of Washington, snow removal activities, especially in mountain passes, are controlled through the use of radio. By means of two-way, short-wave radio sets installed in snow-removal equipment, the central office dispatches units to snow blockades and directs the work by maintaining constant communication with the equipment. Supervisors' cars are also equipped with short-wave receiving sets, thus enabling the supervisors to be called to long distance telephone in cases of necessity for two-way communication. Shop clerks and operators of snow-removal equipment are encouraged to become licensed radio operators. These men carry on their regular duties while operating the radio equipment, and there is practically no expense for special operators to maintain the communication system.

SAND OR CINDERS ARE SPREAD OVER ICE-COVERED HIGHWAYS

Highways frequently become covered with ice during the winter months, rendering them impassable or extremely dangerous to traffic even at slow speeds. This can be remedied by spreading sand or cinders over the ice, thus restoring traction.

Ice may form as a result of a sleet storm, because of faulty snow removal, or because of faulty drainage. Until recently it was the practice to allow a covering of snow, ranging from a fraction of an inch to a few inches in thickness, to remain on the road surface.

ICY PAVEMENTS ARE MADE SAFER FOR TRAFFIC BY SPREADING SAND OR CINDERS AT DANGEROUS PLACES.

Compaction by traffic and alternate thawing and freezing soon transformed this snow into ice. With the increase of winter traffic and hazards from slippery roads there has been a change in practice on principal highways in many States; snow removal crews now scrape off the snow and slush as close as possible to the surface. Use is made of motor graders and light trucks with underbody blades mounted on springs for this work. This equipment is also used for surface and shoulder blading during other seasons of the year.

The formation of ice on pavements caused by water from thawing snowbanks is being eliminated through better snow-removal methods, by opening ditches and drains during thaws, and by a general study of the locations where ice forms so that the drainage facilities can be improved.

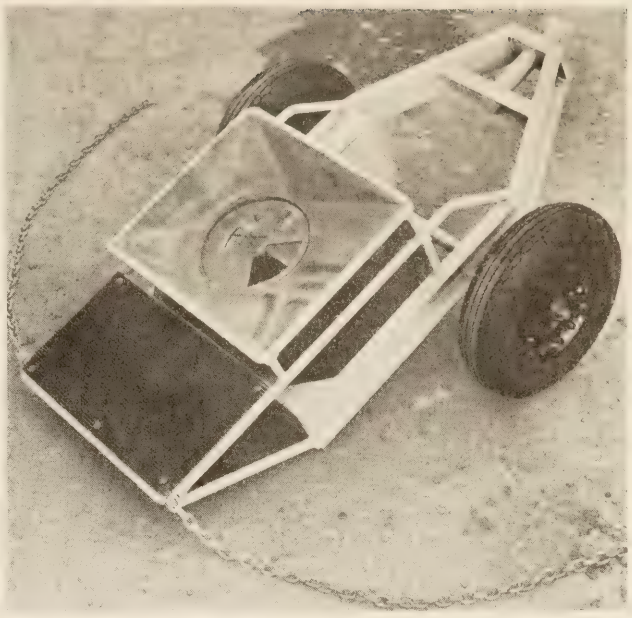
The hazards created by sleet storms or by rain precipitated at near-freezing temperature cannot be avoided. Temperature variations during the day, from temperatures permitting light rains and mists to freezing temperatures, permit a thin coat of ice to form within a very short time. The most effective remedies are: Provision of better traction by applying abrasives to the highway surface as soon as possible; protection with guard rail; the erection of suitable caution signs at approaches to critical sections; the elimination of excessive crown on pavements; and warning the traveling public by radio and other means as to the slippery condition of roads. Drivers should be informed of the things they can do to minimize the danger of skidding

on icy pavements, such as carrying moderate air pressures in tires, using tires having deep treads, and driving at slow speeds so that brakes need be applied but seldom and then very slowly and cautiously.

The most commonly used abrasive is sand with an admixture of calcium chloride or sodium chloride on pavements other than portland-cement concrete. Cinders are preferred by some States, but are usually not available in sufficient quantities. The chemicals are used to assist in partially embedding the abrasives by temporarily lowering the freezing point.

The sand and chloride are generally mixed and stock piled at convenient points or sheltered in bins to prevent the weather from dissipating the salt and to keep the materials from becoming caked. Wherever possible the bins are placed in positions that will expedite handling of materials by gravity loading. Spreading is performed from trucks either by hand shoveling or mechanical spreaders, and directly from stock piles on short and isolated sections. Because of the cost, treatments are largely limited to steep grades, curves, grade crossings, intersections, and other dangerous places where accidents are most likely to occur.

The State of Oregon has developed a sand spreader for ice treatment. It is a trailer, power for spreading being supplied by traction of the trailer wheels through the trailer axle to a drive chain and gears which revolve two disks. The amount of materials spread and the width covered are regulated by manual adjustment of the disks. The trailer is attached to the rear axle, by which it is pulled, and also to the tail gate on the dump body of an end-dump truck. The trailer wheels do not come in contact with the pavement until the dump body is half raised. The abrasives fall through a chute in the tail gate into the feed hopper and onto the spreader disks. Recommended speed of operation is from 5 to 8 miles per hour, depending on the size of materials used. An automatic clutch arrangement near the wheel bearings permits backing of the trailer without operation of the drive mechanism. The machine was used experimentally during the winter of 1936–37, and reports indicate that about 50 machines of this type were constructed for use during the following winter.



Sand Spreader Developed and Used by the Oregon State Highway Department.

It has been reported that the oil film deposited on concrete pavement by passing vehicles seems to act as a protective coating against possible detrimental action of concentrated solutions of chlorides used in ice treatment. Several States are experimenting with linseed oil as a protective coating. In Wisconsin pavement is painted with two coats of the oil prior to the application of calcium or sodium chloride. Sufficient time has not elapsed to permit any definite conclusions, but it is reported that the State proposes to continue the experiments on a larger scale during the winter of 1937–38.

AUTOMOBILE PURCHASES BY FARM FAMILIES

Summary tabulations of a survey of 17,000 farm families in 64 counties in the United States show that 824 of each 1,000 families owned cars. The statistics, summarized in table 1, show that farm families buy nearly twice as many used cars as new cars. Usually these are relatively high-value used cars, although their cost averages only a little over one-third the cost of the new cars purchased—$263 for the average used car, $739 for the average new car.

The counties, surveyed in 1935–36, were representative of farm regions in all parts of the country. The data were collected in the Study of Consumer Purchases conducted by the Bureau of Home Economics of the United States Department of Agriculture as a Works Progress Administration project in cooperation with the Bureau of Labor Statistics of the United States Department of Labor, the National Resources Committee, and the Central Statistical Board.

Because a composite picture of the usual American family was the object of this family-living study, only families having both husband and wife were included.

Car ownership of all nonrelief, native white farm families interviewed ranged as high as 97 percent in California and in North Dakota and Kansas, where distances between cities are great. In Vermont the percentage was 73, still almost three-fourths. Among the white operators of the Southeastern States, more than 60 percent reported owning cars. For Negro sharecroppers, this percentage ran as low as 15. Car ownership the country over averaged a little over 82 percent.

Only in California did the white farm families studied purchase more new than used cars. In most of the other areas studied, twice as many used as new cars were bought. Farm families the country over paid an average of $263 for used cars, $739 for new cars. The purchase price of used cars ranged from $80 in Georgia and Mississippi to $330 in New Jersey; the price of new cars ranged from an average of $637 in North Carolina to $932 in California. Freight charges, of course, make a difference of $100 or more in car prices depending on the distance from the center of production. The price of used cars generally averaged well above $200. A few used cars costing $50 or less were bought, usually by low-income families.

For other areas the percentages of car ownership among the families interviewed were: Michigan and Wisconsin, 94 percent; Illinois and Iowa, 94 percent;

TABLE 1.—*Number of nonrelief farm families [1] owning cars and number buying new and used cars, per 1,000 families; and average price of cars purchased, 1935–36*

Locality	Farm status	Race	Number of families in each 1,000 owning any car	Number of families in each 1,000 buying during the year			Average gross price [2]	
				Any car [3]	New car	Used car	New car	Used car
New England States:								
Vermont	Operators	White	734	140	41	99	$709	$186
Central States:								
New Jersey	do	do	881	139	64	76	761	330
Pennsylvania and Ohio	do	do	859	181	55	128	737	271
Michigan and Wisconsin	do	do	939	197	56	142	696	210
Illinois and Iowa	do	do	938	226	75	153	736	263
Mountain and Plains States:								
Kansas and North Dakota	do	do	965	182	55	127	717	247
Colorado, Montana, and South Dakota	do	do	861	215	107	110	807	303
Pacific Coast States:								
Central and southern California	do	do	971	203	107	96	932	304
Oregon and Washington	do	do	912	181	63	118	869	278
Oregon	Part-time operators	do	919	232	52	180	835	308
Southeastern States: [4]								
North and South Carolina	Operators	do	707	266	118	149	703	311
Do	Sharecroppers	do	448	175	27	148	669	212
North Carolina	Self-sufficing farm operators	do	204	53	10	43	637	223
North and South Carolina	Operators	Negro	425	139	21	118	638	197
Do	Sharecroppers	do	355	148	6	142	750	173
Georgia and Mississippi	Operators	White	622	178	73	106	736	240
Do	Sharecroppers	do	195	52	2	50	776	80
Do	Operators	Negro	246	51	0	51	0	181
Do	Sharecroppers	do	146	59	0	59	0	85
All regions			824	192	70	122	739	263

[1] Families that include husband and wife, both native-born.
[2] This average is based on the number of cars purchased during the year, for which the gross purchase price was reported.
[3] The figure in this column is the sum of the number of families buying new and those buying used cars, unless the same families purchased both types of cars.
[4] Because of the economic and social significance of the system of farm tenancy in the Southeast, these data have been tabulated separately for each type of tenure; hence no justifiable comparisons can be made between any one group in this region and white operators in other regions. Negro farm families were studied only in the Southeast.

Oregon and Washington, 91 percent. A special study of part-time farmers in counties adjacent to Portland, Oreg., showed that 92 percent were car owners. For New Jersey this percentage was 88; for Colorado, Montana, and South Dakota, 86; for Pennsylvania and Ohio, 86.

In the southeastern States, where the farm tenancy system was a factor, and where Negro families constituted a considerable proportion of the farm population studied, the percentages of car ownership for the families interviewed in North and South Carolina were: White operators, 71 percent; white sharecroppers, 45 percent; Negro operators, 42 percent; Negro sharecroppers, 36 percent. In Georgia and Mississippi the percentages were: White operators, 62 percent; white sharecroppers, 20 percent; Negro operators, 25 percent; and Negro sharecroppers, 15 percent.

A special study of the so-called self-sufficing farm area of North Carolina, where farmers raise more for home consumption than they do for market, showed 20 percent car ownership.

Car purchases during the year were reported by 14 percent of the Vermont families interviewed, 4 percent buying new cars and 10 percent buying used cars. Fourteen percent of the New Jersey families also were car buyers, 6 percent buying new cars and 8 percent buying used cars. Eighteen percent of the Pennsylvania and Ohio families purchased 5 percent new cars, 13 percent used cars. In Michigan and Wisconsin, 20 percent bought cars, 6 percent new cars and 14 percent used cars. In Illinois and Iowa, 23 percent bought cars, 8 percent new cars and 15 percent used cars. In Kansas and North Dakota, 18 percent bought cars, 5 percent new cars and 13 percent used cars. In Colorado, Montana, and South Dakota 22 percent bought cars, 11 percent new cars and 11 percent used cars. In California, 20 percent bought cars, 11 percent new cars and 9 percent used cars. In Oregon and Washington, 18 percent bought cars, 6 percent new cars and 12 percent used cars.

In the southeastern States, the new cars were almost all purchased by the white farm operators. In the four States studied in this region (North and South Carolina, Georgia, and Mississippi), less than 3 percent of the white sharecroppers, Negro operators, and Negro sharecroppers reported buying new cars. In Georgia and Mississippi, none of the Negro families reported any new-car purchases. Twenty-seven percent of the North and South Carolina white operators interviewed bought cars during the period studied, 12 percent bought new cars and 15 percent bought used cars. In Georgia and Mississippi 18 percent of the white operators' families purchased cars, 7 percent buying new cars and 11 percent buying used cars. Of all families interviewed the country over, 7 percent reported buying new cars and a little over 12 percent reported buying used cars.

FILM STRIPS ON HIGHWAY SUBJECTS AVAILABLE

Film strips relating to several different highway subjects have recently been made available by the Bureau of Public Roads of the United States Department of Agriculture. Lecture notes containing appropriate comments about each frame have also been prepared. Some of these notes are in the form of question-and-answer discussions by two readers.

"The Country Roadside Restored" is the title of one film strip of 55 frames. This series of pictures begins by showing the attractive roadsides in the old days of horse-drawn traffic. It continues by showing roadsides where beauty has been marred by construction scars, stumps, and unsightly debris. Later pictures show roadsides whose beauty has been retained by carefully planned construction operations or restored by the planting of trees, shrubs, and other plants, by the rounding and trimming of side slopes, and by the removal of unsightly stumps and debris.

Another series is entitled "The Cost of Poor Roads." The economy of good roads is forcefully illustrated in 53 frames, which show that lower car operation costs, superior highway service, greater community social values, and increased safety, all accrue when poor roads are improved.

Methods of stabilizing soil-road surfaces are shown in a strip of 55 frames entitled "Stabilized Soil Roads." Materials used in stabilizing road surfaces and the methods of preparing, mixing, and placing them, are illustrated in detail.

"Subsurface Exploration Using Electricity and Sound Waves" is the title of another series of 37 frames. It is important for highway engineers to have means of determining accurately the location and type of materials below the earth's surface without actually boring into the earth. Layers of rock, shale, clay, and earth offer different amounts of resistance to the passage of electric current and they also transmit sound waves at different speeds. The film shows clearly how, by making use of these phenomena, engineers can measure the depth below the ground surface to rock.

Investigations of highway materials, design, and methods of construction, are pictured in the 69-frame strip entitled "Highway Research Highlights." Roads must be designed to withstand the wear and tear caused by modern high-speed traffic and deterioration resulting from constant exposure to freezing, thawing, rain, snow, etc. Great progress has been made toward making highways stronger and more durable, and at the same time keeping costs as low as possible.

"Open Winter Roads," a 67-frame film strip, is devoted to the subject of snow removal on highways. In the days of horse-drawn traffic, winter snows offered no serious hindrance to travel. Sleighs and sleds were gotten out, and traffic moved on runners instead of wheels. Motor vehicles, however, cannot be operated safely or easily on snow or ice-covered roads. The pictures show the large snow plows, pushed by trucks or tractors, that are now used to remove snow from the highways. Sand or cinders are spread over curves, grades, intersections, and other dangerous places when they become coated with ice.

These pictures are on 35 millimeter, noninflammable film, suitable for projection in film-strip projectors. Suitable projectors may be rented in the large cities from one of the large telegraph companies. Projectors are available in most schools, and can often be rented from automobile dealers who use them in training their salesmen.

The film strips, together with lecture notes, may be borrowed from the Bureau of Public Roads, United States Department of Agriculture, Washington, D. C. There is no charge other than the postage in returning the film (approximately 10 cents).

STATUS OF FEDERAL-AID HIGHWAY PROJECTS

AS OF FEBRUARY 28, 1938

STATE	COMPLETED DURING CURRENT FISCAL YEAR			UNDER CONSTRUCTION			APPROVED FOR CONSTRUCTION			BALANCE OF FUNDS AVAILABLE FOR PROGRAMMED PROJECTS
	Estimated Total Cost	Federal Aid	Miles	Estimated Total Cost	Federal Aid	Miles	Estimated Total Cost	Federal Aid	Miles	
Alabama	$1,122,820	$551,410	64.3	$3,548,911	$1,775,426	156.0	$2,786,010	$1,391,580	122.4	$4,128,765
Arizona	1,689,169	1,221,427	81.6	1,559,947	1,064,457	80.2	563,888	371,176	30.6	462,763
Arkansas	2,852,611	2,847,004	183.8	1,281,294	1,277,611	85.9	23,505	23,177		2,251,127
California	6,772,548	3,738,976	150.0	7,163,159	3,765,555	116.8	1,959,290	1,046,167	40.6	358,556
Colorado	3,172,067	1,771,163	119.8	894,051	484,900	39.1	1,199,789	657,378	29.9	1,481,944
Connecticut	783,198	389,196	9.3	231,520	108,123	.7				1,513,589
Delaware	463,922	229,992	18.1	70,588	35,294	2.8	660,211	302,597	18.0	925,129
Florida	493,182	246,003	20.9	2,915,342	1,457,671	58.4	472,900	236,450	8.0	2,477,059
Georgia	2,110,923	1,020,343	122.5	5,810,489	2,904,836	263.3	1,761,388	880,694	82.0	3,822,664
Idaho	2,593,499	1,532,132	198.9	920,795	549,711	74.0	536,192	318,347	25.4	572,776
Illinois	10,190,017	5,023,351	298.1	5,994,861	2,846,273	147.3	5,816,950	2,908,400	85.9	178,523
Indiana	5,678,897	2,813,569	131.9	2,687,175	1,343,587	86.3	1,969,500	984,750	47.8	1,508,789
Iowa	6,475,119	2,959,914	211.8	4,214,635	1,887,856	126.2	2,471,860	1,151,450	68.5	94,596
Kansas	4,320,090	2,145,611	242.6	2,660,496	1,330,149	47.5	2,390,855	1,195,422	113.7	2,661,077
Kentucky	2,480,778	1,190,389	64.8	3,245,000	1,622,500	97.0	1,869,658	934,829	97.2	1,937,280
Louisiana	583,782	287,228	15.0	6,352,674	1,329,105	39.5	5,980,759	1,037,045	25.9	1,553,863
Maine	1,869,761	934,879	52.6	1,908,936	954,468	42.3	549,530	274,760	13.5	117,452
Maryland	930,330	465,145	13.4	1,814,594	905,534	28.9	460,360	230,180	.5	1,493,949
Massachusetts	4,403,913	2,201,955	20.3	1,880,495	940,247	3.3	636,468	318,234	5.0	1,627,896
Michigan	6,485,843	3,181,092	166.9	5,514,868	2,757,434	130.8	1,652,020	781,710	19.8	1,650
Minnesota	6,201,859	3,086,623	289.6	3,581,631	1,779,571	154.1	1,773,992	876,891	88.7	777,651
Mississippi	2,193,901	1,096,851	102.0	4,479,990	2,239,290	210.6	1,796,240	898,070	74.0	2,398,965
Missouri	8,206,746	4,055,492	446.8	4,719,135	2,271,015	126.4	3,072,726	1,221,271	74.5	1,292,071
Montana	3,824,816	2,144,049	277.7	1,846,412	1,038,231	86.4	571,734	321,594	33.8	1,991,430
Nebraska	2,464,943	1,230,188	255.9	4,393,751	2,184,059	398.4	3,565,182	1,152,278	179.1	1,577,131
Nevada	2,515,471	2,159,343	132.5	693,895	601,641	62.3	79,019	68,520	5.2	704,153
New Hampshire	360,696	177,963	6.5	498,834	246,525	9.5	838,179	394,706	9.9	615,625
New Jersey	2,055,958	950,684	20.3	2,136,030	1,067,695	14.6	519,680	258,955	5.3	1,209,232
New Mexico	2,916,628	1,783,013	229.0	2,324,936	1,517,997	116.6	25,662	15,531		244,516
New York	14,122,720	6,674,595	245.5	12,073,954	5,990,460	210.3	2,175,290	1,086,145	32.1	306,069
North Carolina	4,798,124	2,394,490	372.4	5,228,378	2,443,094	198.7	2,008,470	975,950	99.9	1,318,393
North Dakota	1,020,920	1,011,720	186.5	1,298,310	1,277,800	77.4	1,382,480	1,338,860	86.2	2,006,553
Ohio	3,658,876	1,758,941	51.0	9,308,609	4,617,756	100.5	1,733,320	866,660	18.7	4,859,087
Oklahoma	3,112,937	1,623,792	147.8	3,129,444	1,589,154	125.5	1,778,305	942,681	75.9	2,500,504
Oregon	3,973,517	2,354,927	130.9	1,535,252	897,609	81.0	519,952	317,270	15.0	718,809
Pennsylvania	11,946,751	5,944,779	168.9	7,146,528	3,553,824	99.8	2,705,525	1,351,725	50.6	2,024,731
Rhode Island	1,073,252	527,811	10.2	796,330	398,165	10.8	8,930	4,465		774,458
South Carolina	3,295,514	1,377,203	246.4	5,262,151	2,234,493	223.4	1,125,189	562,035	59.9	770,273
South Dakota	2,452,175	1,386,157	247.0	1,912,136	1,057,337	184.6	695,113	383,412	88.1	2,720,326
Tennessee	1,846,076	922,109	69.5	1,659,804	829,902	53.3	2,477,000	1,238,500	66.7	3,553,006
Texas	11,977,107	5,971,505	821.9	11,188,374	5,558,787	554.9	3,389,375	1,624,752	233.5	3,297,760
Utah	1,329,852	947,399	130.0	774,730	553,692	61.0	190,450	135,720	1.4	975,670
Vermont	1,052,720	505,707	29.6	1,679,730	739,095	43.1	6,730	3,168		61,552
Virginia	2,927,693	1,453,087	140.7	4,084,707	2,002,938	102.7	1,786,028	891,664	53.0	650,908
Washington	1,956,822	1,009,327	75.1	3,663,443	1,922,412	45.9	283,296	148,700	5.8	413,725
West Virginia	1,430,681	719,033	40.9	1,344,007	798,353	39.3	539,320	438,920	10.1	1,736,847
Wisconsin	8,140,567	3,918,966	269.6	4,701,047	2,159,177	107.5	635,299	307,800	11.1	884,384
Wyoming	2,465,437	1,412,048	256.0	1,355,569	822,160	151.8	174,090	107,550	16.6	197,137
District of Columbia	640,163	311,939	11.5	431,329	212,667	6.4	640,320	318,175	12.9	985,427
Hawaii				947,719	471,880	20.0	127,820	63,910	.3	89,210
Puerto Rico										
TOTALS	179,435,391	93,660,520	7,598.3	164,865,995	82,417,516	5,303.1	70,385,849	33,360,254	2,243.0	70,825,050

CURRENT STATUS OF UNITED STATES WORKS PROGRAM HIGHWAY PROJECTS

(AS PROVIDED BY THE EMERGENCY RELIEF APPROPRIATION ACT OF 1935)

AS OF FEBRUARY 28, 1938

STATE	APPORTIONMENT	COMPLETED			UNDER CONSTRUCTION			APPROVED FOR CONSTRUCTION			BALANCE OF FUNDS AVAILABLE FOR PROGRAMMED PROJECTS
		Estimated Total Cost	Works Program Funds	Miles	Estimated Total Cost	Works Program Funds	Miles	Estimated Total Cost	Works Program Funds	Miles	
Alabama	$ 4,151,115	$ 3,923,416	$ 3,874,665	136.9	$ 253,674	$ 247,774	7.8				$ 28,676
Arizona	2,569,841	3,153,137	2,501,556	193.7	38,548	38,548					29,737
Arkansas	3,352,061	3,163,049	3,133,003	351.6	165,042	164,942	8.6				54,115
California	7,747,928	7,954,378	7,579,423	263.9	138,156	138,156					30,349
Colorado	3,395,263	2,382,800	2,290,828	99.4	89,597	87,214	6.0	$ 8,200	$ 8,200		1,009,021
Connecticut	1,418,709	1,367,365	1,250,061	21.2	55,490	55,000	1.2	124,130	64,435	0.2	49,213
Delaware	900,310	871,470	843,920	66.4	10,234	10,234	.2	26,712	17,000	4.4	29,156
Florida	2,597,144	2,603,553	2,529,126	99.1	38,957	38,957					29,061
Georgia	4,988,967	1,962,958	1,912,758	112.3	2,358,364	2,089,984	109.8	497,320	497,320	28.3	488,905
Idaho	2,222,747	2,273,614	2,167,699	185.9	33,341	33,341					21,707
Illinois	8,694,009	8,135,128	7,867,135	465.1	685,010	685,010	23.2				141,864
Indiana	4,941,255	5,211,435	4,816,080	238.0	49,000	49,000					76,175
Iowa	4,991,664	5,241,284	4,885,935	528.3	105,902	104,865	.3				864
Kansas	4,994,975	4,695,661	4,642,082	370.6	251,823	249,650	21.6	46,162	46,162	.6	57,081
Kentucky	3,726,271	3,598,480	3,429,673	355.0	271,221	271,221	3.5				25,377
Louisiana	2,890,429	2,834,996	2,511,943	166.2	300,662	240,049	1.6	97,087	97,070	10.4	41,367
Maine	1,676,799	1,632,402	1,618,549	74.4	58,250	58,250	1.4				
Maryland	1,750,738	773,435	766,648	27.2	467,536	467,536	10.0	271,366	271,366	5.5	245,189
Massachusetts	3,262,885	2,219,079	2,218,903	18.2	896,550	458,710	.6	1,042,586	521,293	.4	63,979
Michigan	6,301,414	6,658,139	5,949,537	288.6	284,921	284,921	3.3	223,938	63,746	.3	3,210
Minnesota	5,277,145	6,383,720	5,170,077	896.0	93,670	85,850	5.8				21,218
Mississippi	3,457,552	3,152,229	3,147,534	220.8	224,146	223,106	14.9	10,800	10,800	.6	76,112
Missouri	6,012,652	5,294,408	5,211,301	777.0	790,784	736,082	.7	34,390	32,294		32,975
Montana	3,676,416	3,593,576	3,563,290	200.7	95,385	95,385	.1	8,462	8,462		9,279
Nebraska	3,870,739	3,432,726	3,321,652	362.3	446,353	446,353	8.3	70,270	70,270	1.8	32,464
Nevada	2,243,074	2,309,014	2,197,401	110.1	84,970	38,146	1.7				7,527
New Hampshire	945,225	875,636	843,253	37.7	121,092	101,301	5.7				671
New Jersey	3,129,805	1,598,383	1,577,527	31.1	1,512,979	1,512,979	4.4	34,468	34,468		4,831
New Mexico	2,871,397	2,811,309	2,805,816	213.7	43,071	43,071		14,681	12,196		10,314
New York	11,046,377	10,726,589	10,261,169	170.0	316,300	276,300	1.9	62,700	62,700	.2	446,209
North Carolina	4,720,173	4,643,501	4,574,722	285.4	120,761	120,761	5.4				24,690
North Dakota	2,867,245	2,488,483	2,440,577	377.9	107,799	107,799	1.2	290,601	290,601	37.5	28,268
Ohio	7,670,815	6,970,681	6,855,102	291.9	717,532	711,532	6.6				104,181
Oklahoma	4,580,670	4,565,720	4,321,366	400.8	239,470	239,470	7.6	8,800	5,000	.1	14,834
Oregon	3,038,642	3,186,986	2,975,094	164.6	45,580	45,580		11,846	11,846	1.0	6,122
Pennsylvania	9,347,797	7,872,088	7,302,979	264.3	2,110,819	1,854,586	21.1	36,737	36,737	.4	153,495
Rhode Island	989,208	1,113,140	989,208	18.8							
South Carolina	2,702,012	2,356,294	2,150,784	226.2	551,692	498,752	23.4	9,664	9,664	1.5	42,811
South Dakota	2,976,454	2,686,769	2,683,046	482.9	270,437	270,437	22.0				22,971
Tennessee	4,192,460	3,531,595	3,480,417	135.3	679,103	679,103	15.5	35,710	22,060	2.6	10,881
Texas	11,989,350	12,592,147	11,536,611	1,107.5	497,808	385,058	13.0	23,100	23,100	4.3	44,581
Utah	2,067,154	2,161,834	1,925,059	207.7	112,055	112,055	.1				30,040
Vermont	924,306	1,052,209	897,536	23.2	13,865	13,865					12,905
Virginia	3,652,667	3,475,512	3,287,636	939.9	131,731	128,434	13.5				236,597
Washington	3,026,161	3,316,821	2,940,420	164.2	65,824	65,824	.7				19,916
West Virginia	2,231,412	2,109,315	1,963,773	86.4	275,022	267,639	14.1				
Wisconsin	4,823,884	5,217,220	4,727,229	343.4	91,394	89,300	.3				7,355
Wyoming	2,219,155	2,173,387	2,165,009	152.4	33,287	33,287					20,859
District of Columbia	949,496	950,000	949,496	8.8							
Hawaii	926,033	946,320	862,482	17.4	9,533	8,907		62,530	54,644	.6	
TOTALS	195,000,000	184,243,391	173,917,090	12,780.4	16,354,740	14,964,324	387.1	3,052,260	2,271,434	100.7	3,847,152

CURRENT STATUS OF UNITED STATES WORKS PROGRAM GRADE CROSSING PROJECTS

(AS PROVIDED BY THE EMERGENCY RELIEF APPROPRIATION ACT OF 1935)

AS OF FEBRUARY 28, 1938

STATE	APPORTIONMENT	COMPLETED					UNDER CONSTRUCTION					APPROVED FOR CONSTRUCTION					BALANCE OF FUNDS AVAILABLE FOR PROGRAMMED PROJECTS
		Estimated Total Cost	Works Program Funds	NUMBER			Estimated Total Cost	Works Program Funds	NUMBER			Estimated Total Cost	Works Program Funds	NUMBER			
				Grade Crossings Eliminated by Separation or Relocation	Grade Crossing Structures Reconstructed	Grade Crossings Protected by Signals or Otherwise			Grade Crossings Eliminated by Separation or Relocation	Grade Crossing Structures Reconstructed	Grade Crossings Protected by Signals or Otherwise			Grade Crossings Eliminated by Separation or Relocation	Grade Crossing Structures Reconstructed	Grade Crossings Protected by Signals or Otherwise	
Alabama	$ 4,034,617	$ 3,546,325	$ 3,530,996	47	1	12	$ 503,819	$ 437,519	5			$ 53,400	$ 53,400	1			$ 12,702
Arizona	1,256,099	1,278,187	1,216,371	15		5	18,841	18,841									20,887
Arkansas	3,574,060	2,880,555	2,873,454	51	6	30	638,836	638,131	5		2	3,535	3,535			1	58,940
California	7,486,362	7,187,501	7,008,095	46	8		414,005	414,004	1			10,000	10,000	5			54,263
Colorado	2,631,567	2,287,197	2,218,984	27	1	21	411,634	411,634	3	2							949
Connecticut	1,712,684	479,557	479,463	3	1	1	1,157,071	1,135,710	7								97,511
Delaware	418,239	130,000	128,144	1			279,052	279,052	2								11,043
Florida	2,827,883	2,412,602	2,384,600	30	5	3	119,018	119,018	1			133,300	133,300			73	190,965
Georgia	4,895,949	809,234	807,128	17	7	16	1,514,089	1,514,089	24	7	3	674,070	674,070	10	1	33	1,900,662
Idaho	1,674,479	1,394,680	1,366,439	20	3	12	252,696	252,696	2		6	4,261	4,261			3	51,083
Illinois	10,307,184	8,785,913	8,659,208	65	8		1,500,134	1,493,730	9			101,000	101,000	2			53,246
Indiana	5,111,096	4,369,155	4,229,336	39	15		857,447	857,447	3		162						24,313
Iowa	5,600,679	4,568,177	4,474,833	98	9	8	1,092,875	1,089,000	8								36,846
Kansas	5,246,258	4,340,606	3,916,002	54		5	1,273,119	1,253,704	4	1		116,072	23,068	2		3	53,484
Kentucky	3,672,387	1,358,467	1,339,494	19	5		1,984,219	1,694,487	5	6		612,579	612,579	3	1		25,827
Louisiana	3,213,467	1,568,629	1,568,621	17	1		880,600	880,580	8	1		649,599	600,110	4	1		164,155
Maine	1,426,861	1,266,779	1,263,012	19	1	4	160,788	142,540	1	1							21,309
Maryland	2,061,751	665,089	660,481	5	3	18	881,174	831,174	5	2	11	283,163	282,277	1	1	1	287,819
Massachusetts	4,210,833	2,993,173	2,990,739	22	4		865,680	865,680	4			249,991	249,991	1			104,423
Michigan	6,765,197	6,864,894	6,560,765	44	8		101,477	101,477				167,000	75,730	1	1		27,225
Minnesota	5,395,441	4,824,965	4,793,348	83	13	50	590,070	584,020	3								18,073
Mississippi	3,241,475	2,326,914	2,321,760	51	5	11	445,900	445,900	6	2	2	217,000	217,000	2		10	256,815
Missouri	6,142,153	4,656,996	4,489,953	41	1		1,633,740	1,633,740	8		1	1,650	1,650			1	16,810
Montana	2,722,327	2,556,515	2,513,626	37	7		245,576	185,931	1	1							22,770
Nebraska	3,556,441	2,885,494	2,841,119	76	3	21	470,813	470,813	5		1	199,683	199,683	3		2	44,827
Nevada	887,260	877,030	845,455	8	3		13,308	13,308				3,630	3,630			5	24,867
New Hampshire	822,484	791,275	791,208	9	4	6	53,297	29,170	1			2,106	2,106			1	
New Jersey	3,983,826	3,107,456	3,094,275	20	6	1	772,334	772,334	4	3		44,730	44,730		1		72,487
New Mexico	1,725,286	1,700,885	1,693,233	19	1		25,879	25,879									6,173
New York	13,577,189	11,553,383	11,223,255	35	45		2,016,770	2,016,770	10	4		155,700	155,550		1		181,614
North Carolina	4,823,958	3,627,198	3,606,819	50	18		1,081,059	1,081,059	12		115						136,080
North Dakota	3,207,473	2,815,524	2,809,317	55	4		389,012	389,012		1							9,144
Ohio	8,439,897	2,476,674	2,355,458	19	6	8	5,664,564	5,196,418	30	2	5	670,000	655,000	10		1	233,021
Oklahoma	5,004,711	3,696,896	3,681,634	58	9	18	1,365,444	1,232,344	7	3	17	17,850	17,850			6	72,883
Oregon	2,334,204	2,291,480	2,249,772	16	6	2	74,215	74,215	1								10,217
Pennsylvania	11,483,613	8,357,476	7,754,595	69	18	9	3,568,378	3,291,343	17	5		150,473	150,473	5			287,202
Rhode Island	699,691	701,817	692,910	4	3												6,781
South Carolina	3,059,956	1,822,071	1,794,712	37	11	26	791,309	791,309	8	5	10	142,578	142,578	1		12	331,358
South Dakota	3,249,086	2,858,119	2,856,522	59	6	54	175,186	175,186	6			269,350	210,393	17			6,985
Tennessee	3,903,979	2,369,028	2,360,347	37	3	32	1,200,670	1,200,670	8	1	3	106,690	106,690	1		5	236,272
Texas	10,855,982	9,952,641	9,939,742	127	14	110	490,931	490,931	1	1	18	63,790	63,790			21	361,519
Utah	1,230,763	1,203,470	1,196,574	17	1	1	18,461	18,461									15,728
Vermont	729,857	751,916	706,638	10	7	20	10,900	10,900									12,319
Virginia	3,774,287	3,000,218	2,864,689	45	19	21	851,838	845,213	7	2	1	8,006	8,006			2	56,378
Washington	3,095,041	2,710,796	2,687,611	22	11	11	368,494	368,069	1	1							39,361
West Virginia	2,677,937	1,286,581	1,284,613	11	3	6	1,311,022	1,310,522	15			78,855	78,855	2		1	3,948
Wisconsin	5,022,683	4,499,995	4,462,992	37	6	7	395,129	394,926		1	11	91,598	24,151			16	140,614
Wyoming	1,360,841	1,213,957	1,203,739	13			111,212	111,212	1								45,890
District of Columbia	410,804	417,779	410,804	3													
Hawaii	453,703	284,891	284,005	3			179,710	169,698	2								
TOTALS	196,000,000	150,806,160	147,486,890	1710	319	549	39,221,795	37,759,866	251	52	368	5,281,659	4,905,456	71	7	197	5,847,788