

and cities In many states all motor vehicle taxes, license or gas, go to the state for state roads In some states it is distributed among the counties and cities In some states part of it is used for other than road purposes There is a growing tendency for the cities and other smaller taxing units to demand a share in these taxes It would appear that it cannot always be resisted How much should go to the state? How much to the cities? How much to the counties? This is the chief bone of contention today in many states when gas tax increases are up for consideration It would seem that a thorough study of this question would prove of great value

The Committee will be grateful for any suggestions or comments on the two subjects noted above or any others that appeal as desirable lines of investigation

## FINANCING A STATE ROAD SYSTEM WITH BONDS<sup>1</sup>

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Inasmuch as a great deal of money is now going into road investments, it behooves us to consider the soundness of the various plans for financing state highway programs It is desirable that we first look for the basic principle underlying highway development

The highway, as well as the motor vehicle, is a part of the transportation machine While we recognize the many social advantages coming from the development of the highway system, we find it difficult to measure their value in concrete terms It is likely, however, that these social advantages exceed in their total value the economic advantages We can, however, measure the economic advantages coming from the development of a state highway system by the saving which results therefrom to the traveling public The value of the social advantages would, of course, be additional to that of the economic advantages

Let us start this discussion by the assumption that every state has a contemplated road program This program may be the reconstruction of part or nearly all of its present system or the widening of certain parts of its system to more nearly fit and keep pace with the constantly growing traffic needs Or this program may mean the grading, bridging and surfacing of a system which is still partly in a dirt road stage

<sup>1</sup> This paper was arranged for by the Committee on Highway Finance in order to stimulate discussion of this important topic The opinions and conclusions are those of the author, and have not been endorsed by the Committee

Three methods of financing are possible in which the motor vehicle owner would bear the burden

(1) A low rate of automobile license fees and gas tax which after all fixed charges of administration and maintenance are taken care of would allow a relatively small surplus of funds available for construction, and which could complete the system in a long period of years

(2) An increased gasoline tax, license fee, or both, which would provide a large surplus that would be capable of completing the program as rapidly as is consistent with economy and good engineering practice

(3) The capitalization of the surplus from a low rate of gasoline tax and automobile license fee by the issuance of bonds in sufficient amount to complete the program as rapidly as is consistent with economy and good engineering practice Either of the first two methods might be classed as a pay-as-you-go method; the latter, of course, as the bond issue method

No investment in a public utility is justified from an economic standpoint unless the saving exceeds the interest charge Whether we borrow money to build state roads, or whether we take it direct from the motor vehicle owners, we must reckon with this interest charge Failure to appreciate this basic principle has misled many good road advocates and caused them to oppose the issuing of bonds for expediting road construction

The pay-as-we-go advocates fail to realize that the burden carried by the motor vehicle owners must always include an interest charge whether the roads are built out of current revenues or out of bond proceeds The millions of dollars contributed each year through license fees and gasoline tax comes from the motor vehicle owners They have the choice of keeping such money invested in private enterprises earning them six per cent or better, or of putting it into road improvements and getting in return transportation satisfaction If motor vehicle owners withdraw money from their private enterprises and put it into road improvement, they must then relinquish the interest or dividends, which their money invested in private enterprises would have brought them The relinquishment of such dividends and interest becomes a burden to be carried by the motor vehicle owners Building roads out of current revenues does not eliminate this interest burden, for if a man's money is worth six per cent in his business, it is worth that much invested in roads or any other public utility

Now the state can borrow money at a lower rate of interest than an individual, so in reality the motor vehicle owners would be better off, if the professional money lender's money might be kept in the road investment drawing four and one half per cent interest and his own money kept in private business enterprises earning six or seven per cent

The real object that we are seeking to obtain, in building a state road

system, is to reduce the financial burden on the motor vehicle owners. In other words, we are seeking those conditions that permit a minimum unit cost of transportation. This is the basic principle.

It is necessary that we have a clear understanding of the items entering into the unit cost of transportation. First we have the cost of the roadway, then the cost of owning and operating the motor vehicle. The cost of the roadway includes the cost of construction, the cost of maintenance, and the cost of amortization. In order to add these three costs, they must be stated in a common unit. For this purpose it is convenient to use annual costs.

Restating the first cost element, we have the annual cost of the roadway equals the interest on investment plus the annual maintenance plus the annual amortization charge. The cost of the roadway is made up of the following items:

$$\left( \begin{array}{c} \text{Cost of} \\ \text{Roadway} \end{array} \right) = \left( \begin{array}{c} \text{Interest on} \\ \text{Investment} \end{array} \right) + \left( \begin{array}{c} \text{Yearly} \\ \text{Maintenance} \end{array} \right) + \left( \begin{array}{c} \text{Amortization} \\ \text{Charge} \end{array} \right)$$

Likewise the cost of owning and operating the vehicle is made up of the following items.

$$\left( \begin{array}{c} \text{Cost of} \\ \text{Vehicle} \end{array} \right) = \left( \begin{array}{c} \text{Interest on} \\ \text{Investment} \end{array} \right) + \left( \begin{array}{c} \text{Insurance} \end{array} \right) + \left( \begin{array}{c} \text{License} \\ \text{\& Taxes} \end{array} \right) + \left( \begin{array}{c} \text{Depreciation} \end{array} \right) \\ + \left( \begin{array}{c} \text{Gasoline} \end{array} \right) + \left( \begin{array}{c} \text{Lubricants} \end{array} \right) + \left( \begin{array}{c} \text{Tires} \end{array} \right) + \left( \begin{array}{c} \text{Repairs and Replacements} \end{array} \right) \\ + \left( \begin{array}{c} \text{Storage} \end{array} \right) + \left( \begin{array}{c} \text{Driver's Salary} \end{array} \right)$$

These are annual costs and can be readily added to the roadway annual cost to arrive at a total yearly cost of transportation. We then have

$$\left( \begin{array}{c} \text{Annual cost of} \\ \text{Transportation} \end{array} \right) = \left( \begin{array}{c} \text{Annual cost of} \\ \text{Roadway} \end{array} \right) + \left( \begin{array}{c} \text{Annual cost of} \\ \text{Vehicle} \end{array} \right)$$

There is an interrelation among these factors, such that a change in one brings about an opposing change in others and a consequent variation in the annual cost of transportation.

If the increase of any item brings about a decrease in the total cost of transportation, then it is good economy to make the increase specified. For example, it has been found, for certain traffic densities, that changing the surface of a gravel road to a higher type, while calling for a greater investment and therefore a larger interest charge, reduces the cost of maintenance, the cost of gasoline, lubricants, tires, and repairs to such an extent that the total cost of transportation is decreased. It is the province of the highway engineer to bring about such an adjustment of these interrelated factors, that the cost of transportation will be reduced to a minimum.

If we can reduce the unit cost of transportation by issuing bonds and expediting the completion of the road system, then the bond method of financing the highways is the logical one

It has been found by observation and traffic counts, that a few main roads carry the bulk of the traffic. State roads connecting principal population centers form the main arteries for motor traffic, and, though embracing a relatively small mileage compared to total miles of roads in a state, carry a large percentage of the traffic

Hence to serve best the interests of the motor vehicle owners, who pay for the roads, the state system should be constructed in a comparatively short time. It is cheaper to pay interest on a bond issue than to pay the excess cost of operating motor vehicles over unimproved roads

In those cases where state roads are only partially improved and a large number of vehicles are traveling over them daily, it becomes economical to issue bonds to hurry the completion of the road system. For the purpose of illustration, let us consider the case of Missouri's road program, where we have a state system of approximately 7600 miles, about one-half completed. We have nearly 700,000 motor vehicles using these roads

As near as we can estimate the average mileage traveled by a Missouri car is 6,500 miles a year, giving us a total of over 4,500,000,000 car miles of transportation annually, of which at least sixty per cent, or 2,700,000,000 miles are on the state road system

With our system only half completed at least 1,000,000,000 miles are traveled annually on the incompleted portion

With an additional cost of two cents a mile for travel on this incompleted system, we are penalizing our traffic \$20,000,000 a year in excess cost of transportation, a loss which would reduce to zero when the system is completed. During the period of construction the average annual loss would be \$10,000,000. If we spend ten years on the pay-as-we-go plan which was our estimate in Missouri of the time necessary without additional funds, the loss to the motor vehicle owners would amount to \$100,000,000. With a bond issue such as we have just voted, providing funds sufficient to complete our system in four years, the loss to motor vehicle owners, due to the noncompletion of the system, will be reduced to \$40,000,000, or a net saving of \$60,000,000 in favor of the bond issue plan

Each state program should be worked out to fit the conditions existing therein. In this short article I have attempted to lay down only basic principles and illustrate their application, without introducing the refinements that would be utilized in the preparation of some specific program

We have also made no attempt to set a value on the many social advantages derived from an earlier completion of a state road system, but

are convinced that this phase of the question is important and worth all of the interest on the bonds. In Missouri this interest item will be \$2.80 a car a year, for the thirty-five year period before the last of the bonds are retired.

## THE PAY-AS-YOU-GO PLAN OF HIGHWAY FINANCING<sup>1</sup>

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Whether highway finances are provided by direct property tax, the sale of bonds, or from motor vehicle revenues, the funds made available should be expended with but one thought in mind—that of furnishing the greatest degree of highway service to the motoring public.

Highway service should include not alone the construction of a limited system of primary roads with a so-called high type surface, but must take into consideration the traffic needs of the entire state. Such traffic needs should be carefully diagnosed well in advance of formulating any plan of highway financing.

The various resources of the state must be thoroughly analyzed before deciding upon the fairest and most economical plan for highway financing.

No plan will be thoroughly successful and satisfactory that does not include, in a fair measure, the needs of both local and inter-city traffic. It must be remembered that the smaller cities and the villages, especially in agricultural states, have been built up largely through the support of the local people. These people patronize the stores, theatres, garages, and other places of business in such towns three hundred and sixty-five days in the year, and must be considered in any fair plan of highway improvement.

The people who contribute most to building up a community or a state are not the motor gypsies who roam from state to state, but the home people who have given so generously of their brain and energy year after year to help build up the community, and it is these people who should receive first consideration when planning increased highway service.

Nearly every family now owns one or more motor vehicles and they naturally desire reasonable highway service. The large majority of owners are willing to pay their fair share of the necessary cost, providing the roads that best serve their needs are included in a plan financed with their money. There is no longer any argument as to who must foot the

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