Chicago, Ill.
February 9, 1921.

OUR NATIONAL HIGHWAY PROBLEMS

Address before Good Roads Convention of American Road Builders.

Prefatory to the discussion on the highway problems which are national in character it should be understood that present conditions are such that a large program of highway improvement should go forward, now and without delay. Funds are available, the State and Federal highway departments are ready to award highway contracts for large mileages. It is estimated that from all sources approximately $622,000,000 is available for highway work.

Admittedly there are many and grave problems in our developing highway program which must be met. Still with more than 3,500,000 unemployed and with the railroads eagerly offering transportation for the necessary material there is every justification for vigorous action to inaugurate a large public works program with confidence that the problems will be adequately solved as, and when, they arise, and should not be made an excuse for delay now.

A former editor of one of our well known Mississippi Valley farm papers liked to go among the people, of whom many hundreds felt in him a personal friend and for him a great affection. He held the confidence of his public because he did not fail to preserve his perspective, and he frankly let the truth be known, even when it brought into question the full wisdom of those who, through their own choosing, had become teachers or publicists. His characterization often times ran thus: - "Them that can, does; them that can't, teaches."

Nationally we are in a transition and reconstruction period from many causes, and as is to be expected, the highway question is one of those acutely affected by these changing conditions. There has been no length of time stability of the requirements with which the highway builder is contending today, to permit the teachers to instruct accurately from the experience of the past. The man who must do, and who will be held responsible for the results, is confused by the contradictory solutions which he and others of his class have thrust upon them. As usual, we are in a great hurry. We cannot wait for the teacher to develop his theories, and we insist that the doer engage upon a vast program of construction entailing expenditures far beyond our extreme conceptions of only a few years ago. We have been turning the clock ahead at a whirligig rate. Fortunately, there has been a powerful brake upon our ability to expend funds, through the very physical handicaps imposed by the task itself. If labor, if rail transportation, if materials are not to be had, it is impossible actually to pay money out of the public treasuries for these purposes.

The highway engineer and the highway administrator are not guaranteed a safe passage through smooth waters, after avoiding the Scylla of a single problem on the one side, or the Charybdis of some other problem on the other. In the development of the highway program in this nation there is involved not one, but a large number of major problems, so extensive that they will constantly demand very large expenditures and the allocation of a great amount of labor and materials to this purpose by the public as a whole, in return for highway service, rendered primarily to the individual, but collectively, to itself. So let us not hope or expect ever to find the final solution for all highway pro-

blems, for they will continue on to the end of the chapter, yet they will not be the same; or, at least, if fundamentally the same, will appear in different guises and with many modifications.

The highway problems which are of an engineering nature are capable of solution if adequately attacked; those which are economic are also capable of solution, but in principle rather than in detail. The application will need always to be localized. Of these two classes, - certainly not minimizing either, - the most immediately serious are economic rather than engineering, and of the economic problems the determination of the amount and character of service which is to be required from the highways is the most important. Only in a few of the more advarced States does an adequate conception exist as to the traffic - present and prospective, - which must be carried over the highways. The character andamount of traffic which the highways must carry can, through painstaking studies, be reasonably determined. Such a study should precede the settling of the second problem which is of immediate importance, that is, the mileage rate of improvement. For example, let it be determined within any State that only the high-class, heavy-duty pavements will be constructed, and automatically the rate of progress has been fixed. There are now two distinct theories of improvement. First, the one which seeks to extend a comparatively limited mileage of high-class roads annually as fast as the funds and available materials and labor will permit. Second, the one which seeks to build a comparatively large mileage of highways to a usable condition in the shortest time possible. This second theory automatically determines that a large percentage of such mileage will be of the lower-cost roads with their well known traffic limitations.

The liberty has been taken with the title of this paper to interpret it as meaning a diagnosis rather than a prescription, but it may be pointed out here as indicating the need for the early establishment of sound economic principles in the administration of our highway work, that the first theory is being applied in some states where assuredly a large mileage of development roads of the lower cost types would serve the traffic under present conditions and for a long time in the future, and the second theory is being applied in some states where such type of roads have already become a liability rather than an asset. The Bureau of Public Roads has within a few days, been requested to revise downward its minimum design and specification requirements for heavy traffic main roads, in one of the most populous states, where the truck traffic is growing by leaps and bounds. At the same time, we are approving plans for roadways in some of the thinly populated sections where, although in our judgment the investment is sound, nevertheless at the rate of improvement possible within the funds that are and can be made available, the mileage of improved highways will not be adequate within a reasonable period to take care of the development of traffic.

Recently there has appeared a most severe criticism of the engineering and administration of a State highway department which has provided good highway service on a selected system of roads into practically all parts of a large state with a minimum expenditure of time and funds. The balance sheet for this system of roads is neglected. The ratio of returns to investment is forgotten because a very moderate percentage of the surfacing has failed and is now in need of reconstruction. Is it any wonder that the necessity for an understanding of the economic problems is given a super position?

This discussion relates more particularly to the economic problems of State and Federal highway administration, which, in a major sense, has been confined to a limited percentage of roads. It is estimated that about 8 per cent of our total road mileage is covered by the state systems on which the state and Federal funds are concentrated. The other 92 per cent of the roads carry much traffic, and the same general discussion applies to each class, but the necessity for a decision as to the expenditures of funds for the extension of a comparatively large mileage, or their concentration on a short mileage of high type roads, relates chiefly to this small percentage of total highway mileage. The total road mileage of the United States would encircle the globe nearly one hundred times. We are now largely concentrating the Federal and State Engineering and administration upon only one-twelfth of this total mileage, and there is a demand for an even smaller concentration of these funds, particularly those which have been appropriated by the Federal Government.

Just now we have literally a pocketful of money. Funds have been made available in large amounts by the Federal Government, the states, the counties and even smaller districts, which have accumulated because of non-expenditure; but we should not hypnotize ourselves into the belief that this condition will continue to exist, unless the balance sheets show profits on these expenditures in the way of highway service to all of the people from whom these funds are contributed. The earning capacity of our roads must be demonstrated. There are plenty of communities, even as large as a whole state, which have already bonded themselves to their legal limit to provide the funds that are available now. Admittedly these limitations are arbitrary rather than fixed by economic considerations. With the task of highway improvement only begun, it is apparent that either new sources of revenue must be found, or these limitations must be changed. I have faith that these limitations can and will be raised to permit of the continuation of a large program of improvement, but such a continuation will come to be more and more dependent upon the balance sheet which we are able to show of profits derived.

The fact that there is not complete concurrence in the concentration of the necessary funds for the building of the better class of highways is well demonstrated by some of the recent measures which have been put before State legislatures, which would require the spreading of the highway funds over large mileages of the lower cost roads, and would effectually prevent the building of the higher cost surfaces where the traffic absolutely demands them. Herein lies one of the chief virtues of the Federal Aid Road Act, and particularly in the provision of the Act which requires thatthe Federal funds must be allocated to projects of substantial construction. Serious problems are confronting the law makers of both the Federal Government,and the States to provide the ways and means for securing sufficient revenues to meet the expenditures called for in the public budgets, even though these be trimmed and cut until they place insurmountable limitations upon the development of many of the highly advisable public activities. It must be clearly apparent to the fair minded that the unanimous support which has been given the Federal Aid Road Act by those in administrative control of the State highway departments, has resulted from the helpful and stabilizing influence which the principles of this Act have brought to bear upon the development of highway legislation and highway policies. We are passing through a period in which the development of these policies is accelerated, but is not the whole history of

the highway movement in this country a succession of steps from one phase to another? The steps which we take now are of greater consequence because it is well demonstrated that the use of the highways has increased from 500 to 1000 per cent in a period of perhaps five years. There are rural highways, contiguous to centers of population of less than one-tenth of that of our largest cities, which today carry as high as twelve to fifteen thousand vehicles during the days of maximum traffic. Assuming that this statement of facts demonstrates the rapidly changing economic conditions which must be encountered, does this not present the problem of insuring stability in the personnel of the highway administrative bodies who are responsible for the development of economically sound policies?

Next to the determination of the economic problems, perhaps none is of greater import than the stabilizing of the administration of highway affairs. It has been pointed out by competent observers that one of the reasons that the highways in England are carrying extremely heavy concentrations of traffic without serious deterioration, is the continuation in office for long periods of competent engineers who have thus been able, through intimate and continuous observation, to apply for the benefit of the locality the knowledge gained at the expense of the community itself. Let it stand out as a bold, unchangeable fact that the public pays for the education of its public servants. Someone has remarked that a change of employees is likely to prove only a change of faults, and there is such a demand now for highway engineers that it must be understood that every man whose education and experience have been along this line grows more valuable to the community with the years of his experience in dealing with the particular problems of the community.

The administration of the Federal Aid Road Act has pointed out certain other problems of a major character. One of these which should be remedied at once is the failure of a large group of States to provide state revenues, as such, to meet the Federal funds. About one-third of the states are in this category. Some of these have been limited, through constitutional inhibitions upon their power to raise revenues for internal improvements. It is apparent that in those States which depend upon the counties or districts to supply funds to meet the Federal Aid appropriations without assistance from the state, the local interests will demand consideration. This influence has not yet seriously affected the logical development of the most important State highways, only because the roads in the different communities which are of the largest importance from the state viewpoint have also been of major importance to their respective localities. This being true, great progress has been made even in the states having no state revenues, upon the development of state and inter state systems. But to be of state and nation-wide service, the improvement of the system must go forward in the communities which can ill afford the luxury of main line highways no matter how badly they are needed. The immediately local use of the highways and the ability of communities to pay, bear a reasonably constant ratio to each other, diminishing or increasing together. But a study of the states shows that interposed between the wealthier communities are those which, although devoting a greater proportion of their wealth to highway improvement, cannot in fairness be required to continue main line highways to complete the state and interstate systems. Only from state and Federal funds can the development of such systems be assured. This same general principle holds

true for the United States as a whole, and it appears that in the near future favorable consideration will be given to the recommendations of the Secretary of Agriculture and the Bureau of Public Roads, that the present equal co-operative funds required from those States having large areas of public lands which are non-productive of revenues but are highly exhaustive of the funds since the highways must be continued across these great expanses, will be decreased in proportion to the percentage of the public lands within their borders.

And after roads, of whatever type, are constructed, comes the major problem of maintenance. Rather let it be said that if the task today is to provide highway service, we cannot afford to wait for the construction of new and modern types of highways. The maintenance should be carried forward now on roads improved and unimproved. The returns will more than compensate the cost. If there is one problem which the road builders of the United States as a whole must learn, it is that of highway maintenance. The continuity and long radius of operation of the motor vehicle require a development of maintenance organizations and maintenance expenditures not heretofore required; but in the same fact lies, because of the service rendered, the justification for the expense involved. We cannot neglect the simple methods of maintenance which have demonstrated their utility. The harrow, the road drag, the blade grader, have a high degree of utility in combination with the motor truck and gas tractor. One state engineer remarked that the wide-spread use of these simpler maintenance tools in his State saved his whole program of higher cost construction, because of the better highway service provided over a large mileage.

As has been pointed out, we have concentrated State and Federal highway organization and funds upon a small mileage of roads, but because service is demanded from all of the roads we cannot neglect the upbuilding of the county organizations. Smaller than county organizations should be done away with as soon as possible, and the administrative conduct of the work in the counties concentrated under competent highway engineers. There should be a correlation between the work of these county engineers and the state highway department. Much of the more involved technical work such as the design of bridges, the planning of standards, designs, development of specifications, can be made applicable not only to State but to county highway work, and the counties should have the benefit of the guidance and support of the state organization. The closer the correlation of the work of these two agencies, the greater service will be rendered to the public, and the more enduring and more generous will be the public support.

The fear arises that this discussion which started as a diagnosis, is becoming argumentative and confined too nearly to the economic and administrative rather than the engineering questions which are of national import. There is too wide-spread a feeling that our highways are not proving adequate under the traffic, and frequently newspaper scare-heads appear that funds are being wasted. Examine any large program of construction honestly, and usually the only conclusion that can be reached is that the engineer has builded as well as the legislative and political control has allowed, and not infrequently the engineer who has produced the highest class results has been displaced because of his inability to stretch the dollars into a larger mileage of roads. In many large programs recommended engineering policies have been mutilated beyond recognition through an attempt to meet the apparent public demand for more miles of roads. During the past year great

progress has been made in directing public attention to the fact that highways must be designed with painstaking care and with scientific knowledge of the local conditions which must be met, and this is perhaps the greatest of our national highway engineering problems today - the design of highways which will use the most available materials - which will take into consideration not generally but specifically, the soil and drainage conditions, the topography and all other local physical facts which bear upon the durability and cost of the construction.

Let it be clearly understood, however, that the engineering and the economics cannot be separated, and that engineering is best which does not design against every possible failure at an impossible cost, but which limits the number of failuresto a low per cent.

A major engineering problem national in its scope is the early determination, by agreement if possible between the road user and the road builder, upon the maximum loads which are to be carried. Although our motor vehicle registration has reached over nine million vehicles, the determining factor in the design of the higher cost roadways is the motor truck which now constitutes not more than about one-tenth of the motor vehicles registered. A recent traffic count in California shows the use of the highways by motor trucks amounts to approximately 13½ per cent of the total traffic. There is no doubt that the design of motor vehicles has been treated largely from the mechanical consideration of the construction of the vehicle itself. The development of these vehicles has taken place so rapidly that the adaptation of the vehicle to the roadways over which it is to be operated has been seriously neglected. On the other hand the highway engineer is forced to give consideration, in his design of modern highways, to the vehicles which are to be operated over them, and it is now time that the interrelationship of the design of highways and the design of motor vehicles be recognized as a fundamental engineering problem without which the development of neither can go forward in a manner that will bring to the public the greatest service from the combination.