

## THE FUTURE OF ROAD BUILDING

by

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Looking backward 20 years and surveying the development of road building in the intervening period, one striking change appears. It is the conversion of road building from a congeries of unorganized and more or less ineffectual local efforts into a highly organized, efficient and productive industry of which the unit is the State instead of the locality.

Though it is not realized by many people this business of road building is one of the nation's largest industries. We are accustomed to think of the manufacture of steel and the making of automobiles as tremendous productive enterprises, but these industries, great as they are, are still not as large as the business of highway building. In December 1920 the steel industry employed less than 600,000 men. In the production of automobiles and motor trucks something over 250,000 men are engaged. Add all the workers who are employed to sell and distribute, store and repair the automobiles and motor trucks and you probably have nearly 500,000 more, a total somewhat less than 750,000. Vast armies of workers these are, but greater than either is the force of a million men that labored last year throughout the road construction season at building and repairing the country's roads. If these figures surprise you, there are other aspects of this tremendous business that will perhaps surprise you no less.

During the year, 1921, the construction of Federal-aid roads amounted to 11,950 miles involving Federal money to the amount of \$94,057,089 and a total expenditure of \$231,963,682. These figures represent 8,595 miles of road in projects wholly completed and the equivalent of 3,355 miles of work done on projects not wholly completed. Seventy-five hundred miles were completed after the first of July; and 24,000 miles since the policy of Federal participation was entered upon in 1916.

Picture a pile of gravel and stone twice as high as the Washington monument and of equal length and breadth, and you will have a fairly accurate notion of the quantity of material required for the Federal-aid roads under construction and completed at the close of last year. To haul that material from the quarry or pit to the road requires a million freight cars. Now place alongside of your stone pile another pile 400 feet high and a little more than 400 feet in width and breadth and you will have some idea of the amount of Portland cement required for the same roads. Expressed in figures it is 17,000,000 barrels.

These are the statistics for Federal-aid roads only. Doubled, they will stand approximately for the whole amount of road work done in the United States. These are sobering figures. They mean that road building has become the nation's more tremendous industry. As it is a distinctly public industry - an industry conducted by the whole people for the benefit of the whole people - it is most decidedly incumbent upon every one of us to consider well the responsibility that goes with participation in such an industry.

I have referred to the change that has taken place in the character of this business within the last 20 years. At the beginning of that period it was in the hands of thousands of local road building bodies. A negligible part of it was then controlled by those pioneers among State highway departments that were organized at that time. By 1916 - five years ago - only 27 per cent was under the control of State departments. Today about 80 per cent of the road construction of the country is under State control. One-half is subject to the supervision of both the State and Federal governments.

The placing of so large a proportion of the work under State control is the result of the Federal-aid act of 1916 which required the creation of a highway department in all States as a condition of the allotment of Federal aid. Seventeen States created highway departments outright as a result of that Act, and many others were strengthened and given larger funds. If there had been no other beneficial results of the act, I should consider the nation more than repaid for the expenditure that has been made. There is of course the very tangible result of these 24,000 miles of road completed. But in the long run the creation and strengthening of these State agencies to replace the local road building bodies will prove to be more important than the roads bought by this first appropriation.

Even more hopeful in its effect upon the future is the relationship of close cooperation into which these 48 State bodies have been drawn with each other and with the Federal bureau. Through their common participation in the Federal-aid work the old barriers

of local prejudice have been removed, and these efficient organizations now profit to the fullest possible extent from the common experience of all.

The Federal Highway Act, approved last November will have an equally important effect. The first act and its amendment built up a great Federal and State Cooperative organization for the building of highways, and provided for the combined organizations the means with which to test their capacity and efficiency by practice. The new act corrects the few defects that were found in the five years of trail and lays down a program for the construction of a great system of interstate and intercounty roads. As we set out to follow the program planned for us we look forward to the time not far removed when we shall have a national system of connected roads, each road a link in the national chain, bearing its due proportion of interstate traffic, yet each a local road as well, serving with well placed lateral roads to distribute and collect the traffic of the rural sections.

How well we shall perform the duties laid upon us rests with the future to disclose. One of the hopeful signs as we set out is the dawning realization of their common interests by highway builders and motor vehicle producers. They realize that their common business is not to produce motor trucks only, or build roads, but rather to provide better transportation, by economic adjustment of the motor vehicle to the highway and the highway to the motor vehicle.

The whole purpose of highway building is to make possible highway transportation, and the common endeavor of the producers of vehicles and roads is to reduce the cost of transportation to the

lowest possible level. I, for one, therefore, should deplore any legislation which limits too greatly the loads which may be hauled over the highways. Laws which blindly fix some maximum weight may prohibit the really profitable traffic and allow less economical and conceivably more destructive vehicles to operate practically unchecked.

I think we may safely leave the question of the proper relation of the road to the vehicle to be determined by the results of the exhaustive researches now actively under way. In this work there is another promise of the success of our huge undertaking. Experience, judgement, superficial observation, heretofore our only guides are now being supplemented by scientific experiments conducted in practically every State. At Arlington, Va., the Bureau of Public Roads is measuring the destructive force of impact and determining its effect upon various road surfaces. By specially devised instruments we measure the effect upon the covered subgrade of loads applied to the surface.

By careful observation we learn that supposedly inert concrete slabs curl up and down daily under the influence of changing temperature. We find that the motion is so responsive to the warmth of the sun that we can almost instantly detect the effect of a passing cloud. In Illinois the State has built a road the public will never use. It has been built solely for experimental purposes and will be tested to destruction by a carefully regulated motor truck traffic. At Pittsburg, California, an oval track 1500-feet in length furnishes the means of experimenting upon various designs of concrete pavements. The Federal Bureau, at its Arlington laboratory and through its investigators in the field has set for itself the problem of the waves that form in gravel and other similar

types of road. And so I might go on to mention investigation after investigation, each aimed at the solution of some specific problem, each being attacked in a truly scientific spirit by earnest investigators whose efforts are coordinated with those of others through the agency of the Advisory Board of Highway Research of the National Research Council.

With State and National administrative bodies working together in close cooperation, the vehicle producers working hand in hand with the road builders, and highway research beginning to bear fruit in more rational methods of design, with the material producers, and contractors keenly alive to their jobs and rendering more perfect service year by year, with sufficient funds available to carry out the extensive programs that are planned there is every reason to indulge a spirit of optimism with regard to the immediate future of highway building.

There is one condition in which there is the possibility of trouble for highway building, which requires rectification as rapidly as the necessary legislation may be obtained. I refer to the high proportion of the cost of our roads for which we continue to assess owners of land. An estimate of the derivation of the \$600,000,000 expended in 1921 for road construction and maintenance shows that 47 per cent of the total expenditure was derived from local road bonds and county township, and district taxes, appropriations and assessments. Thirty-three per cent was derived from State and Federal sources, and only 19 per cent was derived from the taxation of motor vehicles. Of the \$420,000,000 which it is estimated was expended for construction, exclusive of maintenance, the local subdivisions raised more than half and motor vehicles were

charged with but 7 per cent. Practically the whole amount of the local contribution and a goodly part of the money raised by the States are derived from taxes on land, on the theory that the land is benefited and its value enhanced by the construction of the roads. The fairness of this method of taxation under simple and primitive conditions, as when a road is built which gives access to land which has not before had an outlet, may be accepted without question. It was also indisputably fair and just, when the range of highway travel was limited by the immediate locality, that each locality should pay completely for its own roads.

But we are now living under conditions which are neither simple nor primitive and the motor vehicle has extended the range of highway travel so that it is limited only by the extent of the roads constructed. Automobiles stop neither at county nor at State borders but range beyond both over the roads of the nation. The roads we are building are required principally for the use of motor vehicles which have increased in number from half a million in 1910 to 10,000,000 in round numbers in 1921.

Local roads, and all roads, whether we call them county, State, or national roads, are local roads in each locality, - now carry traffic which is made up largely of extra local motor vehicles. It is only fair, therefore, that a part of the burden that is being borne by local land-owners should be shifted to the shoulders of the owners and operators of these motor vehicles.

What part of the cost should be thus shifted and what part we can, fairly, continue to derive by taxation of the land is a matter to

be determined by a very careful consideration of the purposes for which our expenditures are made and the relative service rendered by the roads to the several classes of our population. A summary of 1350 Federal-aid projects completed on December 31, shows that the subdivision of the cost is as follows: Grading, 21 per cent; paving, 61 per cent; shoulders, 1 per cent; structures (such as bridges, culverts, drain pipe, retaining walls, all practically permanent) 14 per cent; engineering, 3 per cent. The relative weight of the several subdivisions varies in the different sections of the country, but in all sections, except the mountainous parts of the country, the cost of pavements exceeds the expenditure for grading and structures. In the New England, Middle Atlantic and East and West North Central States the expenditure for pavements is at least as great as, and in general, greater than the average for the country as a whole. In Connecticut 87 per cent of the money was spent for pavements to accommodate motor vehicles; in Ohio, 85 per cent; in Illinois, 77 per cent. I assume that these figures which are based on Federal-aid projects are indicative of the corresponding figures for State work. In the aggregate, then, it appears that we are spending about 38 per cent of our money to build or improve the road grades and install drainage structures, retaining walls, etc., and to pay for the necessary engineering. The grades and structures are the permanent features of the construction. They remain when the pavements which are placed over them are worn out by the traffic. They add permanently to the value of the land they serve. They represent the opening of the way which is required to give access to property, and once opened the way remains open. This part of our expenditure, therefore, would seem to be a fair charge against



land. The remaining six-tenths of our expenditure is for pavements and their shoulders, - pavements the type of which is dictated by the requirements of motor vehicle traffic. These pavements will be worn out by the traffic, and this portion of our expenditure it will be necessary to repeat, and repeat again as time goes on because of the use of the roads by the vehicles. Does it not seem, then, that here is a part of the cost which should be borne by the traffic? Of course, it may be contended that the land benefits partially by the addition of a pavement to the grade; so also, does the vehicle benefit, and in even larger measure, by the preparation of the grade. And yet it seems logical to view the grades and structures, which have something of the permanency of the land as additions to the land, and the pavements which are demanded by and worn out by the traffic as the particular concern of the traffic.

I am heartily in sympathy with the tendency to adopt a tax upon gasoline used by motor vehicles as a means of raising highway revenues. It seems to be ideally designed to bring in a return for the use of the roads in proportion to the amount of use. Where such use is of benefit to others than the owner of the vehicle, as in the case of the farmer who transports his produce to market by truck, or the manufacturer who ships his commodity, or the transportation company that moves freight and passengers, the tax can be passed on to those who ultimately benefit. Those, on the other hand, who use the roads for personal pleasure will in that way be called upon to pay for their pleasure.