

RURAL HIGHWAYS

The building of highways for the next quarter of a century will be the greatest public undertaking, because a clear perspective has been obtained of the function the highways must serve in the scheme of transportation.

This vision has come only after years of debate and opposition, and it has required a great national catastrophe to awaken the public as a whole to the country's lack of transportation facilities and to the fact that the highways in conjunction with the motor vehicles have provided the only factor of safety when a sudden expansion in transportation was so seriously needed. We are now recognizing for the first time that the failure to inaugurate a large highway improvement program earlier has been holding back the development of one of our vital requirements - more adequate transportation facilities. A thoughtful concern for the future guided by the experiences through which we are passing points surely to the major responsibility of providing generally better transportation and particularly for bringing to the rural communities transportation facilities as adequate as those of the urban centers. Indeed, the degree of development of transportation facilities has become a measure of the progressiveness of any community, and the extent to which the betterment of social conditions,

including educational, recreational and religious activities, depends upon this factor, has become more thoroughly understood. Certainly, for this latter reason alone the availability of adequate transportation is one of the most important factors in the building up of a permanent and sufficient agricultural population.

The astonishing development of the motor vehicle as a means for transportation on the highways has taken place within a very short period. The registration of motor vehicles in 1906 reached only about 48,000, and the growth was comparatively slow until 1914, when the total number in the United States reached 1,700,000. In the last five years, however, the registrations have increased with amazing rapidity to nearly 8,000,000 vehicles, including trucks but exclusive of a large number of motorcycles. It is conservatively estimated that the actual vehicle mile use of the rural highways has increased more than 500 per cent in strictly agricultural communities and more than 1,000 per cent near the larger centers of population. These figures only poorly indicate the availability and wide distribution of the motor vehicle or the extent to which community and short haul transportation of a thoroughly satisfactory character await only upon the development of serviceable highways.

The Federal Aid Road Act of 1916 has resulted in placing in motion a great program of highway development, nation-wide in its extent and it may be recorded now for the first time that highway construction equal to the economic capacity of the country is under way. The original Act approved July 1, 1916, appropriated \$75,000,000 for rural post roads in cooperation with the states, the apportionment to the individual states being in the ratio determined by the miles of post roads, populations and areas. It became apparent from the first that the original appropriation was too small to accomplish the purposes intended, that is, the extensive building of a better class of highways. The first apportionments were not sufficient to provide for any considerable mileage of the more durable types of roadways such as the traffic conditions in a large number of the states were demanding. Also, following the signing of the armistice, the feeling was prevalent that there might be a period of business inactivity leading to a surplus of available labor, and that a large program of road building would be very helpful in such an emergency.

Acting upon a recommendation of the Secretary of Agriculture, the Congress in February, 1919, amended the original act by broadening a number of its provisions and made an additional appropriation of \$200,000,000, to become available for the fiscal years 1919-20 and 21.

By this appropriation two major purposes have been served. First, the building of the more durable types of highways has been greatly encouraged, and second, the preliminary administrative and engineering details for a large mileage of roads have been completed. A great deal of construction could be started quickly and without confusion or waste, at any time conditions warranted or made desirable the furnishing of public employment through public agencies.

Appropriations Available for Expenditure.

In accordance with the provisions of these two acts, prior to July 1, 1919, there had been apportioned and made available to the states for expenditure \$77,600,000. On that date a further apportionment of \$92,150,000, making a total of \$169,750,000, became available for expenditure.

Progress under Federal Aid Plan.

Under the conditions which have prevailed since the summer of 1916 the progress made in placing a large highway program under construction is surprisingly good. An especially fine showing has been made in the advanced road legislation enacted since that time and in the organization of efficient highway departments. The engineering capacity of the highway organizations, State and Federal, and the ability of the states to finance a

large highway program are best shown by the project agreements which have been executed between the Department of Agriculture and the several state highway departments. The record by fiscal years is shown by the following table:

Project Agreements Executed

Fiscal Year	Estimated Total Cost	Federal Aid Allotted	Miles
1917	547,092	224,717	189
1918	14,239,939	5,659,459	1,833
1919	41,631,732	18,048,443	3,768
1920	<u>197,571,626</u>	<u>85,906,556</u>	<u>9,388</u>
	253,990,389	109,838,174	15,178

The project agreements are made after the plans, specifications and estimates have been carefully prepared by the state highway departments and have been examined and approved by the Bureau of Public Roads through which the Secretary directs the road work of the Department. Under these agreements the states contract to carry out the work contemplated in the approved plans. It will be noted that during the fiscal year 1920, a total of \$85,906,556 of Federal funds were allotted on project agreements providing for the construction of 9,388 miles of all types. At the end of the fiscal year June 30, 1920, there remained the sum of \$59,911,726 which had not been placed under project agreement.

If only the rate of progress made during this year is continued the Federal Aid funds will all have been placed under agreement and apportioned to definite projects before the end of the year 1922, well within the time limits fixed for the expiration of the appropriation. At the present time not a single state has failed to meet its share of the funds.

Project Statements and Project Agreements.

During the year 1,770 project statements submitted by the states were approved, involving the improvement of 16,673 miles of road and a total allotment of \$109,329,355 of Federal Aid funds. Project agreements were executed for 1,286 projects, almost three times the largest number executed in any one fiscal year previously, and twice the total number executed prior to this year.

Federal Aid Road Construction.

At the end of the year projects totaling 14,940 miles of highway on which \$103,925,094 of Federal Aid funds had been allotted were under construction, and were in various stages of completion. The estimated amount of Federal Aid allotted for completed work involving 1,677 miles of Federal Aid road for which the Federal Aid allotted amounted to \$8,920,353.

Economic Conditions Affecting Highway Construction.

The work of actual construction has suffered serious handicaps from various causes. These have varied in intensity between the states largely in accordance with the character of the major work under way. In their order of importance, the first is the lack of rail transportation for materials. Authoritative statements from the railroads place their inability to provide sufficient transportation on the unusual development of productive capacity during the war, which resulted in the offering of more commodities for rail movement than before the war, an excessive number of bad order cars, slow movement of cars due to a large number of strikes and to the delays at terminals. During the construction season of 1920 the assignment of open top cars for transporting coal resulted in tying up and slowing down a very large percentage of the highway projects under construction. The delay in completing highways largely due to lack of rail transportation for materials can be well illustrated by results in District No. 2, which includes the states of Illinois, Indiana, Michigan and Kentucky. During 1919 and 1920 contracts involving the construction of 840 miles of highways requiring rail haul for materials were awarded, of which 86.9 per cent, or 746 miles, were awarded during the calendar year 1919. It is now estimated that will be carried over for completion in 1921, 307 miles, or 36.6 per cent.

It will be apparent, therefore, that the lack of rail transportation in these states has resulted in reducing to only a very small amount the number of contracts requiring rail transportation awarded during the year 1920, and also in carrying into the third year construction which was expected to be completed the first year.

The second limitation has been a lack of material, particularly cement, steel and culvert pipe. In general the short supply of sand, gravel, crushed stone and such materials has been a transportation limitation, and not one of plant production.

The third limitation has been the lack of available contractors and labor. This condition was not general, however, and was partially caused by the unwillingness of contractors to undertake new contracts rather than to an actual lack of sufficient organizations.

The fourth principal cause is the difficulty which has existed in some states in disposing of bonds. This cause has not been general and has been due largely to the advance in interest rates since the rates were fixed for the bonds.

There have been other difficult conditions, but these are the more important, and it is apparent that they are largely outside the control of either the Federal or State highway departments. It has become more and more apparent that the physical tasks involved in the building of highways are so great that for a considerable period,

progress will be greatly hampered by economic limitations. On the other hand, it is equally apparent that the rate of progress will be accelerated as these conditions gradually become more normal. Even under the existing handicaps the exercise of energy and determination are rapidly resulting in large mileages of completed highways of serviceable character.

Improvements in Administration Methods

All details of engineering and administrative procedure which have resulted in any delay in inaugurating work have been carefully studied. As far as practicable changes have been made in the regulations to eliminate the cause, and the methods now in use have been reduced to a basis where the preliminary operations can be carried on much more rapidly than actual construction. Every effort has been made to recognize the difficulties and limitations under which the states have been operating, particularly in rebuilding organizations so seriously depleted during the war. Among the principal changes in the regulations are, the arrangement providing for the continuance of work on revised plans approved by the District Engineer even where the revisions are of a major character, an arrangement for sectionalizing projects that work may be placed under contract and sections completed independently of each other, and an arrangement for the use of preliminary construction surveys covering heavy items of

construction which may be approved before the completed plans are ready, thus allowing construction to begin on the heavier items at an earlier date than would otherwise be possible. Also, where the amount of work is sufficient to justify such action, a representative has been placed in each state, and this policy is being extended rapidly in order to facilitate contact between the state and Federal departments. Districts Nos. 1, 2 and 3 in the far west were divided into six districts, largely necessitated by the Forest road construction work, the longer distances and less available transportation facilities. Constant effort has been made to expedite the handling of Federal Aid vouchers and to eliminate delays by passing purely technical errors in vouchers until final settlement is made.

Enlarged Advisory Board.

In order to provide for full correlation of the work of the Federal and State highway departments, the Advisory Board of highway officials has been enlarged to include the full membership of the Executive Committee and the officers of the Association of State Highway Officials. This Association is made up of the administrative and executive officers of the State highway departments of all of the states, and the officers and members of the Executive Committee are elected by the membership to represent the several sections of the country. This policy has made available the

advice and experience of the executives in actual charge of highway work, representing all parts of the country, in formulating administrative policies. The membership of the Board is as follows:

Paul D. Sargent, Chief Engineer, State Highway Department,
Augusta, Maine.

Dr. Joseph Hyde Pratt, Secretary, American Association of
State Highway Officials,
Chapel Hill, N.C.

George E. Johnson, Secretary, Dept. of Public Works,
Lincoln, Nebraska.

W. D. Uhler, Chief Engineer, State Highway Department,
Harrisburg, Penn.

W. E. Neel, State Highway Engineer,
Atlanta, Georgia.

W. S. Keller, State Highway Engineer,
Montgomery, Alabama.

George P. Coleman, State Highway Commissioner,
Richmond, Virginia.

Ira E. Browning, State Road Engineer,
Salt Lake City, Utah.

C. J. Bennett, State Highway Commissioner,
Hartford, Connecticut.

A. B. Fletcher, Highway Engineer, Calif. Highway Commission,
Sacramento, California.

S. E. Bradt, Supt. of Highways,
Springfield, Illinois.

This Board functions through periodical meetings with the Secretary and the Chief of the Bureau of Public Roads, and through correspondence with the membership as a whole and with individual members concerning questions which are sectional in their character. One of the highly important subjects now under consideration by this Board is that of classification of the highways into groups or systems of like importance. This matter is basic in its importance

to the future of highway development in the United States, as it is only through a carefully prepared plan that the work of the several highway building agencies from year to year can be placed on a systematic basis that will provide systems of highways so connected that all classes of traffic will be served. We can not disregard the fact that our progress in the actual construction of highways will be limited for some years to come, and the only policy which should be considered under these conditions is that of building the roads in the order of their importance. Highways as a general rule are first of all local institutions, and the greatest traffic which they must carry is the traffic originating in the immediate vicinity. There is at present much lack of understanding of the functions the highways must serve because of the fact that for some time the use of transportation has not been determined by economic or natural selection. The normal function for which the highways must be developed is the short haul, principally to connect producing areas with rail shipping points and nearby markets. An orderly classification of the highways, however, should be made, and the selection so made persistently followed to the end that as the principal highways of each state are completed they will connect with those of contiguous states and so automatically become links in a national system serving all parts of the country.

Coordination with the War Department.

In order that the military needs for highways will be adequately taken care of in the national program of highway construction, a plan of coordination has been worked out with the War Department providing for an extensive study to determine the roads which should be developed to serve the military establishment.

Cooperation in the highway program extends also to the United States Geological Survey which is preparing a set of highway maps on a uniform scale which will be used by the states and the Federal Department in selecting systems which will best serve the greatest traffic needs. This work is already well under way and a preliminary report will be available within the coming year.

Distribution of Surplus War Equipment and Materials.

The amount of actual road construction and the progress made in better maintenance have been greatly increased by reason of the equipment and materials distributed from the supplies declared surplus by the War Department. The allotment of motor vehicles, principally motor trucks, has been particularly helpful to the states. Of these approximately 23,000 had actually been delivered on October 1, 1920. The surplus TNT has also proven one of the best explosives ever used for road construction. Approximately 16,000,000 pounds have been distributed to the states, and requests have been made for

a greater amount than is available. The state highway departments are in general to be highly commended for the manner in which they are providing for the repair, use and maintenance of the supplies and equipment delivered to them. It can not be seriously questioned that a much greater return in service value will be received by the public than if the items had been sold. The whole distribution will be treated in a later report.

Highway Research.

Many problems in highway construction have arisen with the great increase in the number of vehicles using the roads and particularly with the greater weight of the traffic units which the highways are now expected to carry. The research and investigation involved are of the highest importance, as it must be remembered that highway building is for the primary purpose of cheapening and facilitating transportation. The highways must be designed to take care of the traffic which not only now exists but which will develop, and they must neither be of too cheap a type to prove adequate or too expensive a type to prove economical under long service. Only by the most painstaking and wide investigations and studies can these questions be answered in an authoritative way. In order to have the benefit of the widest possible counsel, a research program has been established in cooperation with the

National Research Council, and a broad highway program is being planned to engage all available agencies. The state highway departments and the educational institutions have facilities which can be used to great advantage in solving these questions. The whole question of highway research is so important that it can well engage the attention of these agencies for the solution of these questions must come now.

National Forest Roads.

The original Federal Aid Act of 1916 carried a total appropriation of \$10,000,000 for the building of roads within the National Forest areas, extending over a period of ten years. The Act of February, 1919, made available an additional total of \$9,000,000 for the same purpose, extending over a three-year period.

In allocating the funds for major road projects in the Forest areas the Secretary functions through the Forest Service, and the actual surveys and construction on these projects are in charge of the Bureau of Public Roads. The road systems in the National Forests are very closely related to those of the states, and the major forest road projects form important links in important state and interstate highways. There are approximately 15,000 miles of roads within the Forest areas which connect with State and county highway systems. It will be seen, therefore, that the building of forest roads is an important part of the general road development

plan of the west, both within and without the forest areas. In addition, the transportation of forest products, the protection and administration of the forests themselves, and the utilization of these areas for recreational purposes are all dependent upon the construction and maintenance of adequate highways.

Preliminary engineering investigations have been made on 4,003 miles of roads and surveys and plans have been made or are in process of preparation on about 2,000 miles. Construction is completed or in progress on 1,300 miles, estimated to cost \$103,000,000. This is at an average cost of \$7,900 per mile, which includes all engineering expenditures. In addition there are a number of cooperative projects which have been built by the states.

There are many trails of a minor character which are necessary for the administration and protection of the forests themselves which are built under the direction of the Forest Service.

Future Highway Program and Policies.

The rapid improvement in the organization of the Federal and state highway departments, the large development of adequate modern highway legislation, the response of the states in making cooperative funds available, the general advance in engineering standards of highway improvement, and the actual construction of the highways, have established, during a period beset with every possible discouraging condition and limitation, the virtue of the Federal Aid

plan for the encouragement of a large program of highway improvement. The fact that the states regard the law as a real cooperative effort on the part of the Federal Government to assist them in the carrying on of a highly important and costly enterprise is evidenced by the fact that the average financial cooperation extended by the states is greater than that required in the Federal Aid Law.

On September 30, 1920, cooperative agreements had been actually executed providing for the construction of 17,174 miles of all types of highways at an estimated cost of \$294,308,581.00 of which the allotment from Federal Aid funds was \$126,924,205. It will be noted that the Federal Aid appropriation is approximately 40 per cent of the total, while the Act allows up to 50 per cent. In other words, the states are providing 60 cents of each dollar used for Federal Aid projects. The immediate future progress of highway improvement is so circumscribed by the economic condition prevailing in the country, largely the outgrowth of the war but partly caused by the greatly increased program of highway construction, that only by large endeavor and the greatest exercise of initiative will these results be at all commensurate with our needs. It has required the experience of five years to develop the present satisfactory status of cooperative administration between the states and the Federal Government, and to put under way a tremendous program of

highway construction limited only by economic considerations. Future Federal highway legislation should not disturb the principles which have been tried out and found satisfactory, and only those changes should be made that experience has shown to be desirable, or to provide the most permanent results.

The Federal Government is interested in correlating the development of the principal highways into systems of equal importance to serve national and military needs, but, in general, the road systems that are planned to serve commercial needs will serve also the military needs, so there need be no conflict in serving both state and Federal requirements.

The Association of State Highway Officials, at the last annual meeting in December, 1919, voted unanimously for the continuance of the Federal Aid plan and additional appropriations at the rate of \$100,000,000 per year. Certain modifications in the present plan are recommended. The first of these is the principle of the expenditure of Federal funds upon those projects that will expedite the completion of an adequate national highway system connecting at the state boundaries. A second important principle is the providing of a modified plan of cooperation for the western states in which there are large areas of publicly owned land. Both of these principles are of the greatest importance and should be made a part of the plan of cooperation; in the first instance, to protect the larger

interests of the public in the development of those roads which are of the greatest importance to the country at large; in the second instance to assist the states which have a large road mileage and whose revenues for internal improvements are seriously curtailed by the extremely large areas of public lands. The very large percentage of these lands in some of the western states is not realized generally. For example, nearly ninety per cent of the entire area of the State of Nevada is public lands, and while this is the extreme case there are other states in which the public lands are a large percentage of the whole.

The apportionment of Federal Aid funds for the fiscal year 1921 is the last provided for in the present legislation.

The acceleration of the expenditure of the funds available can not be accurately determined but it now seems evident that the present appropriation will provide for carrying the program generally into 1922, so that additional appropriations should be made available for that year extending for the next five-year period at the rate of \$100,000,000 per year. The fact that this money will not all be expended by that time must not be allowed to confuse the necessity for action during the present Congress. Over forty of the state legislatures will be in session this winter when it will be necessary for them to pass legislation to provide the funds necessary to meet future Federal Aid appropriations. Most of these

legislatures will not meet in regular session again for two years. At least one year should be allowed the states to collect the necessary funds in their state treasuries after the revenue laws are enacted. Further, it is of the utmost importance that both the Federal and state highway departments should be able to foresee the program for as long a period in advance as possible that the work may be economically planned and the engineering and administrative details carefully executed. It will be apparent that if the future program can be foreseen, economical and adequate methods will be adopted which will mean greater progress and lead to a more systematic development of the highways than can possibly result without such knowledge on the part of the highway departments. Further, efficient contracting organizations are necessary and a short time road building program will not attract the class of contractors whom it is desirable to have actively connected with the work as will a longer program. From every standpoint it is highly important that Federal legislation should be promptly enacted providing for the continuance of the program now inaugurated with the modifications as herein recommended. The relief recommended for the western states could be well extended to the unallotted balance of the present appropriation. It should be noted in this connection that this recommendation does not change the apportionments between the states but applies only to the use made of the funds within the states.

Highway Maintenance.

The most careful consideration indicates the fact that a very large service is demanded from our highways and that the actual building of new highways will for some time be very seriously hampered by the same economic limitations that are delaying new construction of every character. This means that the most careful and painstaking maintenance methods must be adopted to hold in service the highways already built and to insure the longest service from new construction. Under the present Federal Aid laws the maintenance of Federal Aid projects devolves upon the states. Where the maintenance has been taken over by the state organizations it is in general being developed on a sound and efficient basis. In those cases where the state is dependent upon the counties to maintain Federal Aid projects it appears doubtful whether the maintenance will be carried on continuously in an adequate manner. Future Federal Aid legislation should be so framed that the construction funds will not deplete the total funds available for road purposes so that there will not remain sufficient maintenance funds, and it should be made a condition of Federal Aid apportionments in the future that the maintenance of Federal Aid projects should be a matter of state responsibility and funds provided for that purpose.

Mechanical and Engineering Problems of Farm Development.

The greatest advances that have been made in the productivity of labor on the farm have been the result of the application of improved machinery and mechanical appliances. American agriculture is distinguished by the variety and excellence of the farm equipment, but until quite recently the great importance of the proper application of engineering principles to the solution of the mechanical problems of the farm had not been realized, in making more efficient farm labor in production, in lessening the burdens of farm operations particularly in the farm home, or in multiplying the conveniences of farm dwellings and buildings. The Department has for some time been working along these lines and a number of the agricultural colleges have done splendid work in this field. In order to work most effectively, the agricultural engineering work of the Department has recently been organized as the Division of Agricultural Engineering, Bureau of Public Roads.

The objects of the Agricultural Engineering work of the Department are, to better living conditions on the farm by the improvement of housing conditions and the stimulation of the more extended use of time-and-labor-saving devices, to increase the efficiency of the individual farmer so that his productive capacity will be increased and his earnings raised so that he will be able to maintain the American standard of living, and to aid in the

enlargement and improvement of the tillable area of the country by the clearing of cut-over timber lands, the drainage of overflowed and wet lands, and the irrigation of arid lands.

Heretofore no attempt has been made to coordinate the work that was being done in agricultural engineering by the State Colleges, private agencies, and this Department. It is apparent that if the most effective use is to be made of the available funds and facilities, the work of all agencies should be correlated in order that duplication may be avoided. Plans are being developed which when carried out will, it is thought, result in securing close cooperation of state and Federal agencies. Such cooperation should have a stimulating effect on the work in this field.

It was hoped that during the present fiscal year it would be possible to begin work on a comprehensive farm power project along the lines of the program outlined at the Farm Power Conference held in Chicago in October, 1919, a report of which was published as Department Circular No. 149. An increased appropriation was requested for carrying on this important work as well as other basic work in agricultural engineering, but unfortunately Congress did not approve the request. This precludes taking up the investigation of farm power in the comprehensive manner that had been planned, and it is necessary to carry on the work in the most effective manner possible with the limited funds available.