OUTLINE
THE FEDERAL AID ROAD PROGRAM

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1. Review of Federal Aid Road Authorizations and Appropriations.

The original Federal Aid Road Act was approved July 11, 1916; the second Act was approved February 28, 1919, as follows:

Acts of Congress	Fiscal Year 1917	1918	1919	1920	1921
July 11, 1916 (39 Stat-358)	$5,000,000	$10,000,000	$15,000,000	$20,000,000	$25,000,000
Feb. 28, 1919			50,000,000	75,000,000	75,000,000
Totals	$5,000,000	$10,000,000	$65,000,000	$95,000,000	$100,000,000

Before the plan provided was well under way, because of the delays incident to the war period and conditions immediately following, agitation arose to change the basic principle of Federal aid to the States and provide for a system of national highways built entirely by the Federal Government.

Extended hearings were held in 1921, which resulted in a compromise measure - the Federal Highway Act of November 9, 1921. This measure preserved the principle of Federal aid to the States, and laid down a definite plan of procedure for the administration of the Act by the Secretary of Agriculture.

An appropriation was provided as follows:

Act of Congress	Fiscal Year 1922
Nov. 9, 1921 (42 Stat - 216)	$ 75,000,000

In 1922 again after extensive hearings, the Congress authorized a continuance of the program for three years, as follows:

Act of Congress	Fiscal Year 1923	1924	1925
June 19, 1922 (Public No. 244)	$50,000,000	$65,000,000	$75,000,000

This latter Act marked the change in policy from appropriations to authorizations. In the consideration of the appropriations for the fiscal years 1923 and 1924, the Appropriations Committee crystallized a policy of carrying in the appropriation measure for the current year only such sums as it was estimated would be necessary to insure a treasury balance, that is, an amount which, together with balances of former appropriations, would meet the withdrawals from the treasury during the fiscal year. The amounts carried in the three-year authorization program were fixed with a knowledge of the existing unexpended balances from previous appropriations. It is to be noted that these amounts did not fix the size of the annual program which it was possible to carry forward, because of the existing balances.

2. Funds Available and Highway Work Placed under Contract by Fiscal Years.

The Secretary was authorized to apportion the authorizations for the fiscal years 1923 and 1924 to the States and to enter into contracts with them on the basis of the authorized apportionments. This same authorization is carried in the Departmental Bill for 1925. A clearer view, therefore, is given of the progress of Federal aid participation with the States by the following:

July 1	Available for New Construction	Put under Construction During Fiscal Year
1917	$ 4,850,000	
1918	14,550,000	$ 3,144,387
1919	74,456,000	19,344,675
1920	147,261,000	81,436,032
1921	162,825,000	81,366,057
1922	154,584,000	56,777,810
1923	146,556,000	77,492,872
1924	132,438,000	91,000,000 (est.)
1925	114,563,000	94,000,000 (est.)
	20,563,000*	

(*) A reasonable balance must be preserved against the construction program to cover necessary extensions of original estimates.

3. New Contracts for Fiscal Years 1924 and 1925.

The estimate of $91,000,000 to be put under contract the current fiscal year it is believed will be reached, with the probability of an increase for 1925 to $94,000,000. This latter figure is contingent upon conditions in fields of other construction, rail transportation and labor. Public road work is retarded when there is a large construction program of a private character, and accelerated when the other construction work decreases. The general tendency of the Federal aid road work at this time is upward.

4. New Contracts for Fiscal Year 1926.

If the estimate of $94,000,000 to go under construction for 1925 is not reached, but is reduced by $5,000,000 or even $10,000,000, the balance available for new construction will still not be sufficient to carry any reasonable program for 1926.

There are two distinct phases in the orderly administration of a highway improvement program:

(a) the planning

(b) the construction.

The planning includes surveys, estimates, preparation of road and bridge plans, negotiations for right-of-way, etc., letting of contract.

The construction includes the physical performance of the separate jobs.

Economy demands that these two phases shall follow in sequence, the initial stages of each being separated from 6 to 12 months. Time is an essential element. There must be advance notice of the dimensions of the program. There must be time sufficient for the planning. Neither the States or the Federal Bureau can produce the best results with economy without sufficient time interval between the action of Congress and the beginning of operations by the contractor's crew.

These conditions govern so definitely the States that the highway construction program for 1926 hinges largely on what is done by the Congress at this session.

If action is not taken at this session, it is doubtfull if time would permit the framing and enacting of adequate legislation during the short session beginning December next. Even so, a large number of the States would be prevented from planning and preparing for the efficient conduct of the 1926 construction program.

One of the fundamental principles of the Federal Budget plan is elimination of waste and inefficiency in the expenditure of public funds. There is probably no other field of public expenditure in which at this time greater savings are possible through efficient administration. Efficient administration and organization demand positively, first, a continuing program and, second, fore-knowledge of the dimensions of the future annual program.

5. The Budget and Annual Withdrawals from the Treasury.

Upon the establishment of the Budget the concern of the Director of the Budget pivoted upon the actual withdrawals from the Treasury year by year and the following is the history of the amounts included in the Budget for actual payments during each fiscal year. The estimates for the first Budget were thrown out of focus by unforeseen conditions arising in the construction field generally.* Later estimates have been more closely approximated.

Budget 1923

	Estimated Budget Expenditures 1923	Estimated Expenditures 1922
Expenditures for Good Roads	**$ 125,700,000	**$ 105,000,000

(**) The above table includes estimates of additional expenditures during 1923 and 1922 for good roads, authorized by the act of November 9, 1921.

Budget 1924

	Expenditures Estimated, 1924	Estimated, 1923
Cooperative Construction of rural post roads	$ 100,000,000	$ 95,000,000

Budget 1925

	Expenditures Estimated, 1925	Estimated, 1924
Rural Post Roads (good roads, etc.)	$ 90,000,000	$ 85,000,000

(These estimates were all made one and two years in advance).

(*) Rail transportation tie-ups and embargoes, shortage of labor and materials.

6. Relation of Budget Estimates and Actual Withdrawals from Treasury.

For the purposes of a balanced budget, that is, the balancing of receipts against withdrawals from the Treasury, the authorizations or appropriations for Federal aid for any particular year do not govern either the size of the program or the withdrawals from the treasury for that year. The estimates furnished the Director of the Bureau of the Budget are prepared from the detailed records of the Bureau of Public Roads, and are based upon the work under contract, the progress being made, and the monthly reports from the field force. The budget provisions for the current withdrawals for road purposes, and the relatively close approximation to these estimates are shown in the following table:

Fiscal Year	Budget Estimates	Actual Withdrawals from Treasury
1922	$105,000,000	$ 93,140,574*
1923	95,000,000	78,410,616*
1924	85,000,000	54,777,000*(For ½ yr. only, (Approx.) to Dec.31,1923)
1925	90,000,000	

*Includes Federal aid and Forest Road payments.

7. Comparison of Funds Available for New Construction, Funds Involved in Work Placed under Construction, and Withdrawals from Treasury.

This table shows Federal aid funds only. Does not include any Forest road funds.

Fiscal year	Available for new construction at beginning of yr.	Placed under construction during year.	Withdrawals from Treasury during year.
1917	$ 4,850,000		$ 34,338
1918	14,550,000	$ 3,144,000	574,816
1919	74,456,000	19,345,000	2,915,283
1920	147,261,000	81,436,032	20,340,774
1921	162,825,000	81,366,057	57,462,768
1922	154,584,000	56,778,000	89,798,404
1923	146,556,000	77,493,000	71,429,297
1924	132,438,000	91,000,000	85,000,000 (Est.)
1925	114,563,000	94,000,000	90,000,000 (Est.

Withdrawals for 1924 and 1925 are the amounts carried by the Budget for this purpose. Withdrawals first half fiscal year 1924, (July 1 to Dec. 31, 1923) are approximately $45,400,000.

8. Actual Appropriations and Withdrawals from the Treasury.

Total Appropriations, June 30, 1923.		$375,000,000
Total Withdrawals		242,879,291
Balance		$132,120,709
Appropriation 1924		29,300,000
		$161,420,709
Appropriation included in Department of Agriculture bill		13,000,000
		$174,420,709
Estimated withdrawal, 1924	$ 85,000,000	
Estimated withdrawal, 1925	$ 90,000,000	175,000,000

This statement clearly indicates that beginning with the year 1926, there will necessarily be included in the appropriations for that year the full amount of the actual withdrawals from the Treasury that there may be no default of peyments to the States.

The unappropriated balances of authorizations, including that for 1925, are as follows:

$50,000,000 authorization for 1923		$25,000,000
$65,000,000	" " 1924	35,700,000
$75,000,000	" " 1925	62,000,000
	Total	$122,700,000

9. The Federal Aid Highway System.

The Federal Highway Act approved November 9, 1921 provided for the selection by the State highway departments of a system of highways not to exceed 7 per cent of the total highway mileage of each State. Upon this system, all apportionments of Federal aid are to be expended. The system is to be divided into two classes, primary and secondary, of which the former are not to exceed three-sevenths of the total, the remainder to be of the latter class. The Secretary of Agriculture was given authority to approve in whole or in part the systems as designated by the State highway departments or to require modifications or revisions thereof.

The total mileage of existing highways certified by the States was 2,866,061 miles. The States designated by maps and route description, systems of main roads totalling in mileage not more than 7 per cent of the certified mileage. The systems for groups of adjoining States were reviewed by representatives of the States and of the Bureau of Public Roads meeting in a series of conferences for the principal purpose of connecting the systems at State lines. In this way the entire system was coordinated and recommended to the Secretary of Agriculture by the Bureau of Public Roads. The system as approved by the Secretary of Agriculture and represented by the map published November 1, 1923 includes 168,881 miles which is 5.9 per cent of the certified mileage.

10. Progress in Improvement of System.

Up to March 1 the Federal-aid highways which had been completed since the passage of the Federal Aid Road Act in 1916 totalled 33,036 miles, and 13,800 miles were under construction and reported as 59 per cent complete. The total of roads completed and under construction amounted therefore to 46,836 miles. Of the mileage reported as completed on February 29, 6307 miles had been completed during the current fiscal year. All but a very small percentage of this mileage is on the Federal-aid highway system as now established.

In addition to the roads of the system improved with Federal-aid parts of it have been improved without Federal assistance. A careful study is being made of the improvement status of the system and an approximate estimate based upon these incomplete studies is that at the end of the year there were about 60,000 miles of surfaced roads and 8700 miles graded, which leaves nearly 110,000 miles yet to be surfaced.

To bring this system up to serviceable standards, therefore, within the full decade ahead, would mean a surfacing program of about 11,000 miles for each of the ten years,- this in addition to the additions to the system, the separation of grade crossings, reconstruction, and much other work necessary.

The mileage completed has increased year by year since the beginning of Federal aid road construction, that for 1918 being but 12.5 miles while the mileages completed during the following years were: 1919, 177; 1920, 1,493; 1921, 5,787; 1922, 10,247; 1923, 8,820, and for the first eight months of the fiscal year 1924, 6,500 miles.

In addition to the work completed, on March 1, 1924, there were 14,136 miles under construction. The total estimated cost of both the completed work and the work under construction amounted to $844,489,300, of which $372,721,900 represented the Federal participation. The miles completed, the average cost per mile and the percentages of each by types, are as follows:

Types	Miles		Average Total Cost Per Mile	
	Number	Percent	Amount	Percent
Graded and Drained	6,677	20.2	$ 7,658	9.0
Sand Clay	3,507	10.6	7,247	4.5
Gravel	13,019	39.4	9,842	22.6
Waterbound Macadam	885	2.7	18,248	2.9
Bituminous Macadam	1,546	4.7	30,083	8.2
Bituminous Concrete	939	2.8	33,872	5.6
Portland Cement Concrete	5,909	17.9	38,842	40.4
Brick	505	1.5	44,242	3.9
Bridges	49	0.2		2.9
Total	33,036			

11. Highway Research in Material and Design.

A. Stabilized Subgrades.

Subgrades vary from solid rock to exceedingly plastic clay with all combinations of materials between these extremes. The finely divided clays will absorb considerable water by capillarity and become incapable of supporting heavy loads. Moreover, they swell and shrink with changes in moisture content producing heaving and cracking of road surfaces.

Research has shown a way to improve bad subgrade materials. Admixtures of granular materials such as sand, cinders or stone screenings materially cut down the capillary moisture content, greatly decrease the shrinkage and swelling, and materially increase the bearing value of the subgrade under the worst conditions. Similarly, mixtures of hydrated lime and Portland cement in amounts equivalent to only five per cent of the weight of the soil will accomplish the same end. (Curves 1 and 2.) The effect of a five per cent admixture of Portland cement to a depth of one foot seems to have increased the supporting strength of concrete pavements by almost fifty per cent.

The idea of stabilized subgrades is recognized and carried out in a practical way by so-called stage construction in which a surfacing of sand clay or pit run gravel is used originally and until traffic warrants a better surfacing. In exceedingly bad soils, such as adobe of California, a layer of granular material is of value under any type of surfacing.

B. Portland Cement Concrete Roadways.

(1) Cross-section design. The most striking change in highway design brought about through research is the adoption of the thickened edge for concrete highway construction. Hitherto concrete roads have been built thick in the middle and thinner at the edges.

Several years ago the standard design of the Illinois Highway Department was an 8" uniform cross-section whereas now the cross-section is 6" thick at the center and 9" thick at the edges. The resulting saving of several thousand dollars per mile with a thousand mile program has already resulted in a saving of several millions of dollars to the State of Illinois, and moreover, the roads built under the new design should last longer than those built several years ago. The State of Pennsylvania has recently changed their standard designs from a thin edge to a thick edge in both concrete roads and for bases under other types of surfacings.

(2) Joints. Several years ago it was the practice to reinforce pavements very heavily transversely with the idea of preventing longitudinal cracks from forming. Research has shown that it is more economical to build the longitudinal crack into the pavement by providing a joint down the center of the road. Such a joint permits the two sides of the pavement to move vertically, the joint serving as a hinge. In this way the bonding of the slab is practically all confined to the joint.

Notwithstanding very heavy reinforcement under the old system many longitudinal cracks developed which the center joint has eliminated without weakening the surfacing. Longitudinal cracks were dangerous because of their tendency toward forked cracking and because they assume a diagonal direction thus producing corners which fail under heavy loads. It has been shown that a center joint must be so designed that it will be capable of permitting the slabs on both sides to carry a wheel load even though the load is placed directly on only one of these slabs.

(3) Reinforcement. Ideas on road reinforcement have changed rapidly and are still changing and furnish a fruitful field for further research. Some States use no reinforcement and others use steel up to the amount of 100 pounds or more, per 100 square feet, costing as much as $10,000 per mile.

The functions of steel in concrete roads consist of: (1) Increasing the load bearing capacity of the slab. (2) Preventing cracks from separating, thus, (a) reducing maintenance cost (b) probably prolonging the life of the road. Research is needed to show what is the proper amount of steel to use in concrete roads for the greatest economy. Thus far research methods have conclusively shown the efficiency of longitudinal steel placed at the edge of the pavement for stengthening the edge and serving in carrying loads across the joints.

There is no question of the possibility of saving several thousand dollars per mile in new construction when research facts on the proper weight, position and distribution of reinforcing steel are made available.

C. Macadam Roadway Design.

Notwithstanding the vastly different traffic on our present day roads from that of 20 years ago the practice in macadam road building has changed but little. Ordinarily it is common to place a layer of large stone of comparatively uniform size up to, say 3½ inches in diameter, directly on the subgrade and compact this by rolling after filling the voids with screenings.

The effect of heavy loads, however, is to cause a plastic subgrade material to work its way up through macadam built in this manner unless precaution is taken to guard against such action. Both field and laboratory research have demonstrated the possibility of shutting off the penetration of plastic material by the introductionof

a blanket layer of fine granular material between the macadam and the subgrade. It has likewise been shown by field research that the use of a well graded stone including stone dust for the bottom layer is efficient for this purpose.

D. Road Drainage.

Moisture in the subgrade of the road plays a most important part in its load carrying and in its service value. Some soils in the presence of moisture are incapable of supporting loads, therefore investigations of the best methods of drainage have been considered very important. Such investigations have been carried out and one outstanding fact developed is that no system of drainage can remove the moisture held in the soil by capillarity, and in some types of soils even capillary moisture makes the soil very soft and plastic. Drainage systems, however, are very effective in removing free water from the soils and for cutting off sources of free water so that they will not reach the subgrade of the road.

E. Local Materials.

There have been many roads constructed in the past with materials hauled from great distances because it was thought the local and more available materials were not suitable. Research has done much to show how local materials might be used to give very satisfactory service in roads. A research just completed at Arlington on a large number of aggregates has given facts which reassure us of the practicability of using much softer aggregates in concrete road construction than were thought suitable before this research was undertaken. It was shown, for instance, that aggregates having a French coefficient of wear above 6 are perfectly suitable for present day concrete roads and that many gravels previously thought unsuitable may be used. It has also shown how to take advantage of the use of blast furnace slag to obtain satisfactory results. Many sands now rejected by specifications will likewise be made available for road building. The great cost of hauling expensive road materials is thus eliminated from the cost of road building by research methods.

Similarly, local investigations have shown the way to use soft limestone and marl such as occur in Florida and North Carolina. Such materials make excellent bases under more durable road surfacings. Tests have also shown that Florida limestone rock can be used advantageously on penetration macadam construction within a radius of economic haul. The use of local materials for non-rigid bases has been largely developed in the Pacific states and other localities. In certain localities such as Massachusetts, North Carolina and Florida, the only material at hand for road building is fine, clean sand. In such localities a sand-asphalt surfacing which is satisfactory for local traffic, contains 93 per cent of sand, the local material available, requiring the importing of only 7 per cent, the asphalt in the mixture.

Zinc mine tailings, the refuse from the mining of zinc, have likewise been developed for local use in concrete; and rock asphalts occurring in Kentucky, Texas, Oklahoma and elsewhere, have been extensively developed. Specifications have been accepted for Kentucky rock asphalt developed with the cooperation of the producers, and attempts are now being made to develop suitable specifications for controlling the character of the rock asphalt produced in Oklahoma so as to make it more suitable for road construction. Investigations on local materials conducted both in the laboratory and in the field will unquestionably lead to the saving of millions of dollars in the cost of future road construction and have already resulted in substantial savings.

F. Bituminous Concrete.

The heavier loads of the present day have caused considerable waving in a number of roads of the bituminous type. One of the practical results brought about through observation and through laboratory data is the use of a harder grade of asphalt for the various types of bituminous construction. Another change to overcome this defect is the use of more dust in the mixture. At one time one-sized stone bituminous concrete was used as one of the standard mixtures but this has given way to a much better graded, denser and more stable bituminous concrete. Lack of stability leads to unevenness of the road surface with resulting rough riding qualities, higher maintenance cost, and reduction of the life of the road.

Research has shown that a limited number of grades will provide enough variation to take care of different conditions of weather, type of construction and intensity of traffic just as well as a large number of grades. The number of grades has recently been reduced from 100 or more to approximately 15. All of this has been made possible through research and there should be a large saving in the cost of manufacture which should result in decreased cost of road construction.

G. Brick Roads.

The brick road has gone through several stages of development in the past ten years. For years the standard type of brick road consisted of a grouted brick surfacing on a sand cushion laid on a concrete base. Research showed the advantage of a bituminous filler instead of a grout filler. Observation and research also showed the disadvantage of the so-called monolithic construction. In this type the brick are laid directly on the green concrete base and grouted with a Portland cement grout, thus making a monolith. In this type of road many blow-ups resulted from temperature expansion during hot weather and it has been practically abandoned in favor of bituminous filled brick either on a concrete base or on a rolled stone or slag base. Researches have been conducted in an effort to establish the load carrying capacity of different

types of brick pavements as compared with other types of pavements and field researches have done much to show under what conditions the various designs of bases for brick pavements can safely be used.

All of these investigations are conducted with the idea of economy in view. Investigations are invariably conducted at a small fraction of the saving which they ultimately bring about. The sums being spent are so enormous and the mileage of construction so large that the slightest change in design, the opening up of new fields of supply of materials, the development of more economical methods of construction or of maintenance, accumulated over a tremendous road mileage will result in an annual saving of millions of dollars.

12. Stage Construction.

All highway building is a development process. It has always been so and it is not evident that we have on main traffic arteries reached even a relatively stabilized condition. The conditions where roads have been built are comparable to the first main line, single track railways. There is always more to be done - strengthening of road bed, widening of roadway, safety devices, elimination of grade crossings, and other improvements made necessary by a constantly increasing traffic.

The principle became apparent in the States where the larger mileages of surfaced roads had been built as soon as motor vehicle traffic developed to major importance. This principle is fundamental. It is important that it be well understood not only by the highway engineers but by those who make the laws and by the general public.

It is written into a definite statement of policy by this Bureau and is the basis of many project agreements with the States. This principle has been termed in this statement of policy, stage construction. It is termed also progressive construction. Under this policy the Bureau approves projects for the building of roads up to a certain stage with a definite agreement with the State to carry the construction further when funds are available or traffic warrants.

This method is followed -

a. Because of insufficient funds to go further at the time.

b. To allow subgrades to become stabilized thru settlement and compaction.

c. To improve subgrades particularly of the heavy clay or gumbo types.

On such structures, the drainage structures, widths, grades, and alignment are designed and built suitable for the future probable development. Economy and efficient engineering require that stage construction shall conserve the original investment and lend itself without material loss to the progressive steps.

Charts show progressive steps employed in moving from lower to higher types of traffic surfaces.

13. Materials and Labor Prices.

The volume of highway production is considerably influenced by changes in material and labor prices. This varies not only in the United States as a whole but between sections of the country. The price of common labor, for instance, rose from 20 cents per hour in 1915 to 36 cents in 1918, and 49 cents in 1920. It then dropped to 36 cents in 1921 and 32 cents in 1922. It then began to rise a little and for 1923 was 40 cents.

To show the variation between sections it may be noted that in the East South Central States in 1915 labor was 12 cents per hour, while in New England it was 20 cents and in the Pacific and Mountain States it was 26 cents. In all of these States the price rose until in 1920 it was 32 cents in the East South Central States, 49 cents in New England, and from 55 to 60 cents in the Pacific and Mountain States. It dropped again in 1922 in the East South Central States to 20 cents, in New England to 39 cents and 48 cents in the Pacific States, rising again slightly in 1923 to 22 cents in the East South Central, 51 cents in the New England States and 54 cents in the Pacific States.

There was a similar range for prices of road-building materials which gradually rose until in 1920 it was about 150 per cent above the 1915 figures for lumber, a little over 100 per cent for steel, and about 100 per cent for cement. From this high point all materials dropped until 1922.

The results in road construction were that the price of common excavation rose steadily to 1920, fell back again until 1922, and then began to rise again. Similar movements took place in structural concrete and in the pavements. These fluctuations may be shown graphically, and taken together produce variations in the total cost per mile from year to year. For example, if we assume a road with 8,000 cubic yards of excavation, 10,560 square yards of pavement and 75 cubic yards of structural concrete, and use the prevailing labor and material prices for an expenditure of $100,000, the mileages we would have been able to build are:

Year	United States	East South Central	New England
1919	2.9	3.1	2.8
1920	2.4	2.5	1.9
1921	2.6	2.7	2.1
1922	3.3	3.3	2.3
1923	3.0	2.9	2.2

14. Recommended Modifications and Additions to Federal Highway Acts.

A. Increased participation in certain States.

Eleven western States as a group are known as "the Public Land States" because of the large area of land within their borders the title to which rests in the Federal Government. Nine of these States are quite sparsely populated. The lowest percentage of such land in any of these nine States is 6 per cent. This is Montana. The highest is 74.01 per cent. This is Nevada.

The area and population of these nine States is shown as follows:

State	Area Sq. Mi.	Population 1920 - Census	Population Per Sq. Mi.	Percent Public Land
Arizona	113,956	334,162	2.9	18.64
Colorado	103,948	939,629	9.1	11.95
Idaho	83,888	451,866	5.2	16.28
Montana	146,997	548,889	3.8	6.02
Nevada	110,690	77,407	0.7	74.01
New Mexico	122,634	360,350	2.9	21.01
Oregon	96,699	783,389	8.2	22.15
Utah	84,990	449,396	4.5	49.26
Wyoming	97,914	194,402	2.0	26.90

The average population of all the States is 35.5 per square mile.

Large areas in this region have practically no population. Large areas have a high altitude, restricted rainfall, and a short growing season.

These nine States with their civil sub-divisions, the Bureau of the Census reports, have increased their average indebtedness since 1912 by 226 per cent compared with an increase of 124 per cent for the remaining States. The average per capita tax paid in these States for 1922 was $43 as compared with $27 for all the other States.

Twelve per cent of the Federal Aid Highway System lies within these States and they have 4.1 per cent of the population and 6.9 per cent of the assessed valuation.

As a matter of comparison on the basis of a $100,000,000 Federal aid apportionment, these States would raise $2.00 per capita as compared with eighty-three cents per capita, the average for the remaining States as a single group.

In this area, particularly in the inter-mountain States, it is of great national concern that certain specific roads or links in trans-continental routes shall be expedited. These specific roads may not be of first concern to the States in which they lie. The road west of Salt Lake City across the Great Salt Lake Desert is an outstanding example. The precedent for construction of such roads with greater participation than the present established scales for general application has been fixed in the Act of 1921 providing for payment of such part of the cost as the Secretary of Agriculture shall approve in roads across Indian reservations. There are some such projects in which the full cost is to be paid from the State's apportionment of Federal aid funds.

Such increased participation should apply only to sections of the primary road and should be granted only in those cases where the economic advantages to the State would not be so fully served as by the expenditure of the same funds at the time on some other part of the system.

On the basis of these conditions, it is recommended that with carefully guarded restrictions the Secretary be given authority to approve increased participation up to the full cost from the Federal allotments to the State on application by the State on sections of the primary roads of the Federal Aid Highway System where conditions justify. Such action should be based upon the national service to be rendered by any road so improved and upon the desirability of connecting the Pacific Coast with the Mississippi Valley and the eastern States by serviceable routes.

B. Removal of Limitations per Mile.

There are numerous limitations -

(a) Federal funds may be used for labor and material only - no right-of-way payments for land or damages or other incidentals.

(b) Preliminary engineering paid by State.

(c) Contingencies and engineering may not exceed 10 per cent of cost of construction.

(d) Federal payments may not exceed 50 per cent of actual cost.

There are numerous specific requirements -

(a) All funds must be expended on Federal Aid System.

(b) There must be ample right-of-way.

(c) Surfacing in primary roads must be adequate to carry present and future traffic and not less than 18 feet in width.

(d) Secretary requires high standards in design and construction.

(e) Secretary is required to give preference to project that will complete an adequate system of inter-state roads.

In view of these specific limitations and requirements, the further limitation of fifteen thousand dollars per mile is an embarrassment in the proper administration of the Act. It has the effect of denying Federal aid where most needed and loses to the Federal government and the Bureau of Public Roads the weight of moral authority necessary in the cooperative relations with the States.

Federal aid serves very different purposes in the several States, depending upon the stage to which they have each carried their development program -

Specifically -

Reconstruction of heavy arterial roads -

New York - Massachusetts - Connecticut

Construction of new arteries to serve special conditions -

New Jersey

Building grades in rugged topography -

Ohio - Western States

Swamp road construction on links of main roads -

Louisiana.

C. Increase in Percentage for Administration.

The Federal Highway Acts of 1916 and 1919 provided that three per cent of the Federal aid apportionment could be used for administration of the Acts. This percentage was changed in the Act of 1921 to 2½ per cent. In the meantime, items heretofore carried for highway research in the Agricultural Departmental bill have been dropped, and most of the research, physical and economic, conducted by the Bureau, must be carried on from the administrative fund. Further, there was placed upon the Bureau the distribution of war surplus without any appropriation for the necessary overhead. In fact, the only way that this distribution has been carried on has been through the advancement of the necessary cost from the administrative fund of the Bureau, a part of which is reimbursable from the States. The cost of Federal supervision up to the present time is 2.36 per cent of the Federal funds. This, on a fifty-fifty division of cost, would be 1.18 per cent of the total Federal and State funds expended. Since the division of cost has been about 43 Federal and 57 State, Federal supervision has actually averaged about 1.15 per cent of the total funds supervised. It is estimated that the cost of Federal supervision will increase about one tenth per cent per annum on account of the constantly growing mileage of completed roads which must be regularly inspected and reported upon as to condition of maintenance.

The Federal appropriation in cooperation with the States is limited to expenditures for labor and materials only. Only this administrative percentage is available for research. It is very desirable to extend the field of research into every State because of the large number of local problems and the possibility of developing better and cheaper methods and materials for highway construction. That there may be larger funds for use for research purposes is the principal reason for requesting the increase in the administrative percentage. It is not contemplated that the regular force employed on the regular field and engineering work will be materially changed.

D. Provision should be made by which the Secretary of Agriculture may enter into conferences with other countries concerning road building practices, procedures, progress and particularly with those countries touching the borders of the United States where the necessity for international connections in the highways is already making itself felt.

15. Highway Income, State and Local.

In 1904 the total income of all rural road purposes amounted to about $79,500,000. This included an estimated value of about $20,000,000 in statute labor. In 1914 the total had risen to $240,250,000, of which the statute labor was negligible. This was an increase of 202 per cent. The income continued to rise in the years that followed until it reached $1,150,000,000 in 1921.

Total Income for all Rural Highway Purposes, 1921

Bonds	$ 438,109,273	38.1 %
Taxes	415,680,010	36.2 "
Motor fees	118,942,706	10.3 "
Gas	3,683,460	0.3 "
Federal aid and forest funds	*79,333,226	6.9 "
All others	93,689,221	8.2 "
Grand Total	$1,149,437,896	100.0 "

* - From state reports.

Income to Local Highway Funds, 1921

Local Bonds	$324,805,071	43.6 %
Taxes	329,353,420	44.3 "
Motor vehicle fees	17,658,227	2.4 "
Gasoline Taxes	409,472	0.1 "
All other sources, transfers, etc.	71,673,307	9.6 "
Total Income to Local Highway Funds	$743,899,497	64.7 "

Income to State Highway Funds, 1921

State Bonds	$113,304,202	27.9 %
Assessment Certificates (Iowa)	1,521,435	0.4 "
State Taxes, Direct	46,206,583	11.4 "
State appropriations from general funds	20,817,354	5.1 "
Funds received from counties, towns, etc.	29,302,653	7.2 "
Motor vehicle fees	101,284,479	25.0 "
Gasoline Tax	3,273,988	0.8 "
Federal aid and forest fund payments credited to road funds	79,333,226	19.6 "
Miscellaneous sources	10,494,479	2.6 "
Total Income to State Highway Funds	$405,538,399	35.3 %

Subsequent to 1921 no close estimates of the income for rural road work have been made. It is believed they will not vary greatly from those for 1921.

16. Expenditures, State and Local.

The total disbursements during 1921 by all States, counties, townships and districts for all highway purposes, including interest and payment on highway bonds amounted to a total of $1,036,588,000, of which $626,965,000 or 60.5 per cent was for work classed as "construction", while 34 per cent was for "maintenance", and 8.6 per cent for payment of principal and interest on highway bonds. This expenditure was made approximately 40 per cent by or under the supervision of the State highway departments and 60 per cent by local communities without supervision. These expenditures were divided as follows:

Expenditures - 1921

By or under Control of State Highway Departments

State and State-aid construction	$ 291,973,813	70.7 %
State and State-aid maintenance	74,526,746	18.0 "
Engineering and administration	18,881,855	4.6 "
All other items (a)	27,859,248	6.7 "
Total, States	$ 413,241,662	39.9 %

(a) Includes payments of interest and principal of highway bonds, purchase of gravel pits, quarries, etc.

Local Expenditures - 1921

Construction, all classes	$ 334,991,560	53.7 %
Maintenance	174,066,423	27.9 "
Engineering and administration	17,149,498	2.8 "
All other items (a)	97,136,629	15.6 "
Total, Local	$ 623,346,110	60.1 %
Grand Total Expenditures, 1921	$1,036,587,772	100.0 %

(a) Includes payments of interest and principal of highway bonds, purchase of gravel pits, quarries, etc.

During 1922 complete data in regard to all items of highway expenditures is not available. However, for the items of construction, maintenance, engineering and administration data is available. Assuming that the payment of interest on highway bonds, loans, and other miscellaneous items bore the same relation to the total in 1922 as in 1921, we have the following:

By or under the control of State highway departments	$ 458,000,000
Local expenditures	553,000,000
Total for 1922	$1,011,000,000

These estimates show increase in expenditures, $45,000,000 over 1921 by the State highway departments, while local expenditures decreased about $70,350,000.

Definite data as to the 1923 expenditures will not be available until about the first of July. However, at the beginning of the year the various States reported $943,340,000 as being then available for highway expenditure during the year 1923. Taking into consideration the fact that the year 1923 was an active construction year in most parts of the United States, it seems conservative to assume that the total rural highway expenditures during 1923 was at least equal to those of 1921.

Total Expenditures for All Highway Purposes
Consolidated Data for States and Counties, Townships and Districts
Year Ended December 31, 1921.

1	2	3	4	5	6	7
Item	Counties Townships Districts	Per Cent	By or under supervision St. Hwy. Dept.	Per Cent	Total	Per Cent
Construction Roads and Bridges	$316,225,470	51	$296,665,335	72	$ 612,890,805	59
Per Cent	51		49		100	
Maintenance Roads and Bridges	174,066,423	28	69,835,224	17	243,901,647	23
Per Cent	72		18		100	
Unsegregated Construction and Maintenance	*18,766,090	3	-		18,766,090	2
Per Cent	100		-		100	
Administration and Engineering	17,149,498	3	18,881,855	4	36,031,353	4
Per Cent	47		53		100	
Principal and Interest Payments	71,739,457	11	17,541,489	4	89,280,946	8
Per Cent	80		20		100	
Purchase & Repair of Machinery, Equipment & General Miscellaneous	25,399,172	4	10,317,759	3	35,716,931	4
Per Cent	71		29		100	
Total	$623,346,110	100	$413,241,662	100	$1,036,587,772	100
Per Cent	60		40		100	

*Adjustments made in tabulated figures for construction and maintenance items in columns 4 and 6 on basis of 75 per cent construction and 25 per cent maintenance.

Total Expenditures for All Rural Highways
And for all Places with a Population of 2500 and over.
Includes all street and alley surface construction, repair, maintenance, street cleaning and street lighting.

Total expenditures on Rural Roads		$1,036,587,772
Total expenditures on city streets *	$332,243,348	
Street cleaning & lighting	50,675,733	382,919,081
Total		$1,419,506,853

* 2267 cities reported out of a total of 2788.

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Population 1921 107,853,284

Per capita rural and city highway expenditure $13.20

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Total passenger car and motor truck registration 1921 10,463,295

Rural and city highway expenditure per motor vehicle $136.00

Total Income for All Rural Road Purposes
Consolidated Data for all States, Counties, Townships and Districts
Year Ended December 31, 1921.

	Amount	Per cent
Bonds	$438,109,273	38.1
Federal and Forest Road aid	79,333,226	6.9
Motor vehicles - Fees $118,942,706 Gasoline tax 3,683,460	122,626,166	10.6
General Property Taxes	415,680,010	36.2
All other sources	93,689,221	8.2
Total	$1,149,437,896	100.0