# A REVIEW OF HIGHWAY PROGRESS

By Thos. H. MacDonald, Chief,
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at Annual Convention of
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Not long ago the question was asked if the quality of highway engineering technique and administration is advancing in step with the increase in expenditure of Federal highway funds. Concern was expressed that with the problem of providing employment so acute, and with the consequent pressure to get work under way rapidly to the full extent of available funds, there might be a let-down in standards heretofore existing.

Such a question is a most natural one. There have been previous experiences which justify a doubt. Also, it is a difficult question to answer convincingly because of the magnitude of the sum total of the thousands of individual projects involved. No mere assertion of opinion is important except as it accurately reflects a conclusion that may logically be drawn from the facts. There is another and broader question, that of the direction in which we are going and the indicated implications as to the future.

While those constituting the American Road Builders Association have what may be termed the interest of responsibility, the general public has the interest of user and owner. The consequences of an operation of nation-wide dimensions and of such a personal service character reach far into the future. A road system is not rebuilt annually. To be a sound public business, roads into which public funds have gone must earn more than their annual upkeep. The difference between an asset and a liability is decidedly more than a matter of opinion. Thus it appears important to present in as concise a manner as possible a review of highway progress covering a number of years, to record the facts and to develop the important trends as support for the conclusions reached.

## BASE PERIOD 1925-1929.

All measurements are relative, and for the purpose of this review where comparisons are made the five-year average, 1925-1929, is taken as the basing period. This average was selected some time ago by the Bureau as the most representative of the highway improvement activity as a whole, prior to the depression.

## MILES COMPLETED.

As an over-all picture of highway improvement, without distinction as to the degree, or between types, the base

period 1925-1929 shows an average annual completion of 17,577 miles without Federal participation in the cost and 10,063 with Federal participation, a total of 27,640 miles.

The succeeding 5-year period, 1930-1934, shows an average annual completion of 22,068 miles from State funds without participation in the cost from Federal highway funds administered by the Bureau of Public Roads. The State funds in some States were increased through loans and grants administered by the Public Works Administration and also by support from the Federal Emergency Relief Administration. In addition, there was an average annual completion of 15,514 miles with the whole or a part of the cost met from Federal highway funds administered by the Bureau of Public Roads. Together, these total an average annual completion of 37,582 miles or nearly 10,000 miles per year above the preceding 5-year average. These averages, however, fail to show the major influences which the Public Works appropriation of June, 1933, and succeeding Federal appropriations have had in holding highway building to the high level for this period. For the two years 1933-1934 the average completion mainly through State expenditures dropped to 15,963 miles and for the same period the average mileage completed with the cost in whole or in part from Federal funds administered through the Bureau rose to 20,048 miles. Together, the average for this two-year period

is 36,012 miles. Without the record for 1935 and 1936 the conditions are such that it may be predicted the same relative results will inevitably follow for these years.

For the years 1933-1936 inclusive, the Federal appropriations for highways are the major influence in holding the average annual mileage completion at a figure well above the average for the pre-depression base period and very close to the highest 5-year average. (See Schedule 1).

HIGHWAY FUNDS.

Essentially the same story is told by a study of highway funds. Divided among the major purposes for which they are used, the following averages show the trends:

For construction by the States:

| | | |
|---|---|---|
| Average expenditures from State funds For the 5-year base period | - $367,000,000 | |
| Federal aid funds | - 82,000,000** | |
| Total annual average | - | $449,000,000 |
| For the 5-year period 1930-1934: | | |
| State funds | - $403,000,000* | |
| Federal aid and grants | - 192,000,000** | |
| Total annual average | - | $595,000,000 |
| For the 2-year period 1933-1934: | | |
| State funds | - $234,000,000* | |
| Federal aid and grants | - 257,000,000** | |
| Total annual average | - | $491,000,000 |

* May include some Federal grants from the Public Works Administration or Relief Administration.

** Only includes funds administered through Bureau of Public Roads.

In 1934, for the first time since the original Federal-aid act of 1916, the Federal contribution for construction rose well above that of the States. This will also be true undoubtedly for the 2-year average of 1935-1936.

For maintenance, equipment, interest and miscellaneous -

Annual average for the 5-year base period - $225,700,000

Annual average for the 5-year period 1930-1934 - 258,700,000.

In 1934 the expenditures for these purposes were $293,400,000, an amount $34,700,000 higher than the average for the 5-year period and $74,200,000 higher than for the previous year.

For construction, maintenance and miscellaneous expenditures by local governments -

Annual average for the 5-year base period - $615,700,000

Annual average for the 5-year period 1930-1934 - 528,800,000

Annual average for the 2-year period 1933-1934 - 388,000,000.

The average annual expenditure by the local governments for the 2-year period 1933-1934 falls below the average for the five years 1930-1934, by $140,800,000 and below the average for the base period 1925-1929 - $227,700,000. (For expenditures by years see Schedule 2).

SURFACED MILEAGES.

During the 5-year base period the net progress on the State highway systems in the construction and reconstruction of surfaced

roadways was made up of 42,575 miles of low type and 33,640 miles of high type road surfacings, an average annual net increase of 15,243 miles and a total net increase for the period of 76,215 miles.

For the 5-year period 1930-1934 corresponding net increases were 45,823 miles of low type construction, 34,841 miles of high type construction, an average annual net increase of 16,133 miles and a total net increase of 80,664 miles.

On the face of these figures, the first five years of the depression produced 4,400 miles net increase in surfaced roadways on the State highways over the production for the preceding five years of prosperity. Actually, the real gain was much larger, in part due to a more accurate classification of types, and in part to a marked advance in the standards of design and construction. (For details by years see Schedule 3).

SECONDARY ROADS UNDER STATE CONTROL.

In addition to the increase in the mileages of surfaced roadways on the State highways, there has been a very important advance in the improvement of secondary roads which have been placed under the control of State highway departments in the period 1932-1934.

The total surfaced mileage on secondary roads under State control increased 51,000, the details of which are shown in Schedule 4.

There is no other new departure from the previously existing general plan of administration of highway affairs that is as likely to make the same rapid progress as the changing of local roads to the control of the State highway departments. The compelling motives are two: - First, to place the cost burden upon the State for the purpose of lowering or doing away with local road taxes, and second, to secure for the secondary roads a larger participation in the gas taxes and motor vehicle license fees, plus the benefits of administration under the State highway departments. This move would undoubtedly be in the direction of efficiency and economy, if the States were provided with the necessary funds. All of the States which up to this time have been required to take over all or a large part of secondary roads have been given the added responsibility without a commensurate increase in support funds. Were it not for the heavy increases in Federal highway funds which must be regarded as temporary, these States would now find themselves in an impossible situation. The inevitable results of continuation of the policy as it has been put into effect will be to stop necessary new construction and reconstruction of the principal State arterial highways. Sane policies of administration should take exactly the opposite direction. The major highways must be continuously brought to the highest serviceability to provide the inducement for a greater traffic use from which increased revenues may be obtained.

SECONDARY ROADS UNDER LOCAL CONTROL.

One of the most striking changes is in the accelerated increase in mileages of surfaced secondary or local roads. During the 5-year base period, 1925-1929, surfacings were increased by 99,530 miles low type, and 15,022 miles high type, roadways. For the 5-year period, 1930-1934, there was an increase in surfaced mileage of 211,900 miles low type, and 6,247 high type, road surfaces - a total of 218,000 miles or nearly double the increase in surfaced roadways for the preceding 5-year period. This increase reflects both increased support for local roads from the road user revenues, the gas and motor vehicle taxes, work made possible through loans and grants from the Public Works Administration and large support from the Federal Emergency Relief Administration and the Federal agencies established to provide employment.

During the period that the greatest increase in rural road mileage has taken place, local revenues from local sources, have materially decreased. In this connection see Schedule No. 5.

TYPES OF HIGHWAY IMPROVEMENTS.

As an illustration of the build-up of the large highway construction programs and the different types which constitute the program, Schedule 6 is submitted.

This program has been financed for the major part from Federal grants with minor participation by the State, and

differs from previous Federal aid programs in that approximately 25 per cent of the funds were used for improvements of secondary roads, 25 per cent for municipal improvements and the remaining 50 per cent on the rural Federal aid system. The large mileage of gravel surfacings reflects the improvement of secondary roads.

DISTINCTION BETWEEN CONTRACT AND FORCE ACCOUNT WORK.

The policy of doing public construction work by force account has frequently agitated those engaged in the contracting business. As an indication of the conduct of the Federal highway work from Federal grants administered by the Bureau the attached Schedule No. 7 is submitted.

In this schedule the status of the program for the final week of each of the years 1934 and 1935 divided between contracting and force account work is shown.

Force account projects constitute so minor a part of the program as to dispel any real cause for valid criticism from the contracting industry. The fact should be further noted that most of the projects included in the force account program are for secondary road construction where the individual projects are small and hardly suitable for contracting. There has been only one instance where force account has been carried on by the State beyond reasonable limits and this policy has since been abandoned.

PRICE TRENDS AND COSTS

The relative average prices for road construction have been calculated by using a composite mile made up of the different units of work in proportion as these were used in the total program. The composite mile at the prices bid for the 5-year base period, 1925-1929, gave a cost index of $17,026. This index dropped sharply for 1932 to about 60 per cent. It rose in 1933 to an average of 74 per cent. It continued slightly upward in 1934 and for 1935 leveled off at approximately 80 per cent. We would therefore at this time be paying approximately 80 per cent of the cost for the pre-depression period if it were not for the factor of changes in design. The changes and adaptation of modern highway designs to present day needs are discussed in another paper by Mr. R. E. Toms, Chief, Division of Design, Bureau of Public Roads, and will not be touched upon here except insofar as they affect cost.

There has been a gradual increase in the number of units of construction used through the design changes to provide better and safer highways, so that compared with the average number of units used for the base period the index now stands as an average at slightly above 140 per cent. That is, about 42 per cent more units are being used per mile of standard highway construction than for the base period.

Since the price index stands at approximately 80 per cent the cost of the very much better designed and constructed highways has only increased to approximately 114 per cent.

On the basis of this showing as to prices and costs, therefore, while so serious a need exists for the providing of employment and for the construction and reconstruction of highways, it is a sound public policy to give maximum employment upon the highways so long as this can be done within the reasonable costs now prevailing.

THE PROGRAM FOR THE IMMEDIATE FUTURE.

The opportunity is now presented for one of the largest annual construction programs we have ever had. A summary of the Federal appropriations available to the State for construction during 1936 amounts to a total of $579,291,000 which is divided approximately as follows:

This summary is made up of balances of the Federal highway grants and the regular Federal aid funds for 1936, plus State funds which have been programmed.

| | | |
|---|---|---|
| 1. | Going contracts | - $152,344,000 |
| 2. | Plans approved, ready for contract | - 113,884,000 |
| 3. | Funds available for new projects | - 333,300,000 |
| 4. | Total | - $599,528,000 |

On the above showing it is apparent that the greatest activity and the highest cooperation must prevail among all agencies in order to get this very large program under way and push it vigorously for the purpose of providing the largest amount of employment possible and of demonstrating the possibility of sound highway construction as an employment measure.

While there has been some tendency to find fault with the rules and regulations governing highway improvement, it must be taken into consideration that the reason these funds have been provided in such large amounts is for the purpose of furnishing employment, and the regulations have been established to secure this objective. A discussion as to the amounts of labor provided by highway construction is provided in a paper prepared for this meeting by Mr. T. Warren Allen, Chief Division of Management, Bureau of Public Roads, so will not be touched upon further here. It is important, however, that if the highway industry is to fulfill the purposes for which these funds were supplied, the programs must be put under way more rapidly than it has been in previous months and labor must be given employment in rapidly increasing numbers.

Schedule 1.

Miles Completed

| | Without Federal Participation | With Federal Participation | Total Built |
|---|---|---|---|
| 1925 | 12,152 | 11,000 | 23,152 |
| 1926 | 15,830 | 10,722 | 26,552 |
| 1927 | 16,502 | 10,220 | 26,722 |
| 1928 | 19,496 | 9,756 | 29,252 |
| 1929 | 23,904 | 8,618 | 32,522 |
| 5 yr. average | 17,577 | 10,063 | 27,640 |
| 1930 | 24,844 | 10,433 | 35,277 |
| 1931 | 28,634 | 16,000 | 44,634 |
| 1932 | 24,933 | 11,038 | 35,971 |
| 1933 | 14,926 | 18,545 | 33,471 |
| 1934 | 17,001 | 21,552 | 38,553 |
| 5 yr. average | 22,068 | 15,514 | 37,581 |

Schedule 2.

State and Federal Expenditures on State Systems
and Funds Expended on Local Roads

| Year | State funds for | | Federal funds | Funds Expended on Local Roads |
|---|---|---|---|---|
| | Construction | Maintenance, equipment, interest, and miscl. | | |
| | Million | Million | Million | Million |
| 1925 | $ 297.1 | $ 208.6 | $ 92.2 | $ 543.5 |
| 1926 | 277.0 | 219.8 | 79.2 | 587.7 |
| 1927 | 324.1 | 236.3 | 80.2 | 643.4 |
| 1928 | 457.2 | 221.3 | 80.8 | 659.2 |
| 1929 | 479.8 | 242.5 | 77.6 | 644.8 |
| 5-year average | 367.0 | 225.7 | 82.0 | 615.7 |
| 1930 | 620.7 | 266.9 | 92.5 | 700.5 |
| 1931 | 512.9 | 248.6 | 218.1 | 637.2 |
| 1932 | 414.6 | 265.3 | 136.9 | 530.1 |
| 1933 | 266.3 | 219.2 | 180.6 | 413.8 |
| 1934 | 203.2 | 293.4 | 334.5 | 362.3 |
| 5-year average | 403.5 | 258.7 | 192.5 | 528.8 |

Schedule 3.

## STATE HIGHWAY SYSTEM MILEAGE EXISTING HIGH AND LOW-TYPE SURFACING

| Year | Total surfaced miles | Low-type surfaced miles | High-type surfaced miles |
|---|---|---|---|
| 1925 | 144,854 | 96,505 | 48,349 |
| 1926 | 163,059 | 109,110 | 53,949 |
| 1927 | 176,566 | 116,427 | 60,139 |
| 1928 | 193,138 | 124,765 | 68,373 |
| 1929 | 208,324 | 133,211 | 75 113 |
| 5 yr. average | 177,188 | 116,003 | 61,184 |
| 1930 | 226,772 | 142,659 | 84,113 |
| 1931 | 242,700 | 146,359 | 96,341 |
| 1932 | 260,484 | 151,782 | 108,702 |
| 1933 | 271,845 | 157,995 | 113,850 |
| 1934 | 288,988 | 179,034 | 1/ 109,954 |
| 5 yr. average | 258,157 | 155,565 | 102,592 |

1/ Drop in high-type mileage due to resurvey of Texas system, as a result of which approximately 6,000 miles previously reported as bituminous macadam were assigned to the lower types.

Schedule 4.

## SECONDARY ROADS UNDER STATE CONTROL

| Year | Total surfaced miles | Low-type surfaced miles | High-type surfaced miles |
|---|---|---|---|
| 1932 | 5,576 | 4,543 | 1,033 |
| 1933 | 38,648 | 36,440 | 2,208 |
| 1934 | 57,077 | 55,166 | 1/ 1,911 |

1/ Decrease due to miscellaneous adjustments in State records.

Schedule 5.

Local Road Mileage Existing

| Year | Total surfaced miles | Low-type surfaced miles | High-type surfaced miles |
|---|---|---|---|
| 1925 | 376,406 | 348,409 | 27,997 |
| 1926 | 387,005 | 357,967 | 29,038 |
| 1927 | 412,155 | 380,358 | 31,797 |
| 1928 | 432,999 | 398,813 | 34,186 |
| 1929 | 454,111 | 416,770 | 37,341 |
| 5 yr. average | 412,535 | 380,463 | 32,072 |
| 1930 | 467,338 | 425,742 | 41,596 |
| 1931 | 587.028 | 541,614 | 45,414 |
| 1932 | 595,999 | 549,767 | 46,232 |
| 1933 | 642.423 | 594,403 | 48,020 |
| 1934 | *672,254 | *628,666 | *43,588 |
| 5 yr. average | 593,008 | 548,038 | 44,970 |

* 7 States estimated

U. S. PUBLIC WORKS HIGHWAY PROJECTS
(From 1934 Public Works Appropriation $400,000,000 apportioned June 23, 1933)
and
(1935 Hayden-Cartwright $200,000,000 apportionment, June 19, 1934)

Schedule 6

Summary by Types of Construction - December 31
(This summary table is accumulative)

| Types | 1933 Estimated Total Cost Thousands | 1933 Miles | 1934 Estimated Total Cost Thousands | 1934 Miles | 1935 Estimated Total Cost Thousands | 1935 Miles |
|---|---|---|---|---|---|---|
| Graded and drained | 32,170 | 4,149.0 | 54,503 | 6,561.5 | 59,322 | 6,969.8 |
| Sand Clay, Untreated | 2,708 | 569.9 | 3,546 | 975.6 | 4,289 | 1,155.5 |
| Treated | 4,205 | 557.7 | 9,199 | 1,048.4 | 10,861 | 1,199.0 |
| Gravel, Untreated | 32,646 | 4,973.5 | 66,077 | 9,351.7 | 80,940 | 11,121.9 |
| Treated | 12,038 | 1,317.7 | 13,012 | 1,291.6 | 16,540 | 1,776.3 |
| Macadam, Untreated | 2,312 | 203.8 | 2,148 | 208.1 | 2,303 | 179.4 |
| Treated | 3,877 | 238.5 | 12,932 | 867.1 | 15,275 | 991.5 |
| Low cost bituminous mix | 15,918 | 1,801.1 | 29,716 | 3,232.6 | 35,801 | 3,739.7 |
| Bituminous macadam | 10,248 | 461.1 | 20,407 | 1,006.5 | 21,812 | 1,051.4 |
| Bituminous concrete | 22,806 | 706.0 | 46,324 | 1,328.1 | 56,398 | 1,655.3 |
| Portland cement concrete | 91,418 | 2,520.9 | 163,522 | 4,297.9 | 190,474 | 4,947.9 |
| Block | 4,509 | 63.0 | 9,699 | 121.9 | 11,417 | 140.5 |
| Bridges & Approaches | 32,262 | 72.2 (2431) | 69,426 | 124.9 (5055) | 82,730 | 154.9 (5767) |
| Grade separations) Railroad-Highway ) | 5,811 | 12.1 (150) | 24,509 | 39.2 (524) | 33,634 | 51.8 (675) |
| Grade separations) Between highways ) | 704 | .5 (9) | 2,827 | 1.4 (49) | 3,702 | 1.9 (69) |
| Miscellaneous | 216 | | 2,977 | | 7,096 | |
| Total | 273,848 | 17,647.0 | 530,824 | 30,456.5 | 632,594 | 35,136.8 |

Note: The figures in parentheses indicate the number of structures.

Schedule 7

SUMMARY STATUS HIGHWAY PROGRAM
(From 1934 Public Works Appropriation $400,000,000
apportioned June 23, 1933)
and
(1935 Hayden-Cartwright $200,000,000 apportionment, June 19, 1934)
Week ending Dec. 29, 1934.

| | Contract Only | | | Force Account Only | | |
|---|---|---|---|---|---|---|
| | Estimated Cost (thousands) | Mileage | No. of Proj. | Estimated Cost (thousands) | Mileage | No. of Proj. |
| roved | $29,135 | 1350 | 585 | | | |
| tract Awarded | 32,374 | 1881 | 697 | $1,137 | 88 | 97 |
| er Construction | 138,124 | 6081 | 2062 | 9,635 | 828 | 353 |
| pleted | 297,607 | 17750 | 6395 | 22,762 | 2476 | 939 |
| TOTAL | 497,240 | 27062 | 9739 | 33,584 | 3393 | 1389 |
| | Week ending Dec. 31, 1935 | | | | | |
| TOTAL | 596,463 | 31901 | 12165 | 36,131 | 3235 | 1713 |