DEPARTMENT OF ECONOMICS, FINANCE AND ADMINISTRATION

The Capital Investment in Highways

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LARGE capital outlays have been made for construction of highways, roads, and streets over the past four decades. Improvements achieved with these outlays are not permanent; they start depreciating from the day they are first built. This report represents the initial effort to measure the extent of such depreciation experienced by all highways, roads, and streets, in total. The analysis covers the period 1914 to 1952 and is presented in terms of the estimated price level as of January 1, 1953.

In the years prior to World War II, the trend of depreciated investment in all highways, roads, and streets was upward. During World War II, however, capital outlays for construction were insufficient to meet the depreciation taking place and the trend was reversed. Although capital outlays again exceeded depreciation in the postwar period, it has taken until January 1, 1953, for the depreciated investment to recover to its 1941 level.

Certain data are shown for principal road systems and fixed assets solely for purposes of portraying the analysis processes employed. Since it was necessary to use estimates where gaps in the basic data were encountered, it is to be expected that as further research on this subject is conducted, some of the detailed statistics will be revised. It is likely, however, that these revisions will cause no substantial change in the conclusions which may be drawn from the over-all trends and general findings for all highways, roads, and streets, combined.

● OVER the past 35 to 40 years about $75 billion, at today's prices,[1] have been spent for the construction of highways, roads, and streets in the United States. This is a tremendous sum of money. Yet in state after state where highway needs studies have been conducted, there is overwhelming evidence that it has not been enough. In the postwar years, particularly, rates of accomplishment have been lagging notoriously.

Highway construction expenditures per registered vehicle since 1946 are about half of what they were in the prewar period. This fact raises certain questions concerning what has happened and what is happening to the investment that has been created through an expenditure of $75 billion:

How much potential service has been built into the highway systems?

How much of this service has been consumed?

How much still remains?

How fast is it wearing out?

Is ground being gained or lost?

In the analysis which follows, an effort is made to obtain answers to some of these questions.

In large measure the nature of available data relating to mileage, costs, service lives, etc., dictates the type of analysis that can be made. Many gaps exist in the data. These have been bridged on the most-reasonable basis short of incurring the need for indefinite postponement

[1] Unless otherwise stated, all dollar amounts presented in this report are at the estimated price level as of January 1, 1953.

TABLE 1
CONSTRUCTION EXPENDITURES FOR ALL ROADS AND STREETS IN THE UNITED STATES, 1914 TO 1952

1	2	3	4	5	6	7
Year	Total, All Systems, Unadjusted for Price Level[a]	Construction Price Index (January 1, 1953 = 100 Percent)	Construction Expenditures for Principal Road and Street Systems, Adjusted to Price Level as of January 1, 1953			
			Total	Rural State Primary and Secondary	County, Local and Other Rural Roads[b]	All Urban Streets
	million dollars	*percent*	*million dollars*	*million dollars*	*million dollars*	*million dollars*
1914	281	41.8	673	275	22	376
1915	283	42.6	665	296	59	310
1916	310	52.5	590	270	53	267
1917	321	72.2	445	209	43	193
1918	275	80.6	341	176	31	134
1919	404	85.1	475	253	29	193
1920	593	94.8	626	365	31	230
1921	832	59.9	1,389	681	369	339
1922	834	59.4	1,406	667	361	378
1923	755	66.2	1,141	588	195	358
1924	948	63.5	1,493	745	263	485
1925	1,036	60.3	1,718	781	307	630
1926	1,015	58.0	1,749	719	351	679
1927	1,171	57.2	2,047	785	428	834
1928	1,295	53.5	2,421	1,084	447	890
1929	1,272	51.7	2,460	1,116	427	917
1930	1,524	48.1	3,169	1,422	628	1,119
1931	1,430	43.1	3,318	1,731	633	954
1932	983	34.2	2,874	1,541	584	749
1933	882	43.0	2,051	1,140	428	483
1934	1,195	47.1	2,538	1,170	659	709
1935	944	45.2	2,089	901	604	584
1936	1,578	46.5	3,392	1,342	1,096	954
1937	1,375	44.6	3,083	1,166	933	984
1938	1,701	40.9	4,159	1,313	1,437	1,409
1939	1,572	40.7	3,861	1,356	1,358	1,147
1940	1,468	40.2	3,652	1,522	1,207	923
1941	1,178	45.9	2,567	1,188	791	588
1942	797	61.7	1,292	656	328	308
1943	435	71.2	612	348	141	123
1944	373	64.8	575	315	123	137
1945	367	62.7	585	340	129	116
1946	818	69.0	1,185	710	268	207
1947	1,403	78.8	1,780	953	425	402
1948	1,774	88.8	1,998	1,085	445	468
1949	2,144	85.7	2,503	1,231	573	699
1950	2,312	81.8	2,826	1,259	741	826
1951	2,581	91.8	2,812	1,265	761	786
1952	2,882	97.1	2,968	1,588	630	750
Total	43,341	—	75,528	34,552	18,338	22,638

[a] Entries in this column are preliminary. Official statistics of the Bureau of Public Roads published after October, 1952 may show minor variations from these amounts. The effect of such variations upon the over-all analysis will be insignificant.

[b] Includes local roads under state control.

of the analysis. Certain data for 1952 have been estimated in order that the results would show conditions as they exist today, and thus be of more current interest.

CONSTRUCTION EXPENDITURES

A historical record of construction expenditures is an obvious need for any analysis of the investment in highways. Shown in Columns 1 and 2 of Table 1 are the expenditures for construction for each year 1914 to 1952 for all roads and streets in the United States. For this entire period the total expenditure, unadjusted for price level changes, amounts to more than $43 billion.[2] One of the more-troublesome tasks was that of arraying the data in a form suitable for analysis. For example, it was necessary to segregate state expenditures by road systems, rural and urban. In addition, expenditures were made on many roads which today are state primary or secondary roads but which were local roads in earlier years. Thus, certain adjustments were made in order to produce a continuous record which would reflect the actual capital outlays made each year since 1914 on each road system as now constituted, regardless of which highway jurisdictions may have made the expenditures.

As indicated in Table 1, the principal road systems selected for purposes of this analysis were (1) the rural state primary and secondary systems, (2) county, local, and other rural roads, and (3) all urban streets. The approximate mileage of each of these road systems as of January 1, 1953, is:

System	Approximate existing mileage, January 1, 1953
Rural state primary and secondary	459,000
County, local, and other rural roads	2,528,000
All urban streets	339,000
Total	3,326,000

For purposes of analysis, expenditures on each system were reduced to a common price level. In making this adjustment, the Bureau of Public Roads' composite-mile construction-price index was used for the period 1922 to 1952. This index was extended back to 1914 by tying it in with the wholesale-price index of the Bureau of Labor Statistics. The entire trend from 1914 to 1952 was then adjusted to the

[2] This amount includes expenditures for the construction of toll facilities. It also includes WPA construction expenditures during the 1930's. Expenditure data were obtained from statistical records maintained by the Bureau of Public Roads. It is known that substantial capital outlays were made in years prior to 1914, particularly for city streets. However, the year 1914 was selected as the starting point of the analysis for the following reasons: (1) there is lack of adequate records of expenditures prior to 1914 and (2) it was considered desirable to start the analysis at some year during the period when motor vehicles began to have pronounced effect upon highway, road, and street improvement programs.

estimated price level on January 1, 1953, as a base of 100. Resultant values are shown in Column 3 of Table 1.[3]

Price-index values listed in Column 3 of Table 1 were then applied to (1) the total expenditures in Column 2 and (2) the expenditures developed separately for each principal road system comprising the total. Results of this computation are shown in Columns 4 to 7 of Table 1.

Figure 1 shows construction expenditures for all highways, roads, and streets from 1914 through 1952. Solid bars represent actual amounts; stippled bars show these same expenditures adjusted to the estimated price level as of January 1, 1953. (Values used in Figure 1 are obtained from Columns 2 and 4 of Table 1.) Actual expenditures as shown by the solid bars have been highest in the years following World War II. When adjusted for the price level, however, peak expenditures, as shown by the stippled bars, are found to be in the early and late 1930's.

FIXED ASSETS

Various elements of the highway, such as grading, surfacing, structures, traffic services, improved shoulders, roadside development, and so on, have different service-life characteristics. Available data are not sufficiently detailed to permit breaking down the expenditures into the number of fixed assets which would be desirable for this analysis. In fact, existing factual information concerning this matter is so meager as to render the validity of any breakdown open to considerable question. Yet, because of the wide variation in the service-life characteristics involved, an attempt was made to subdivide expenditures into five major fixed asset accounts: (1) grading, (2) low-type surfacing, (3) intermediate-type surfacing, (4) high-type surfacing, and (5) structures.

Following is a brief description of these fixed asset accounts:

1. *Grading* includes costs of right-of-way (where actually purchased), clearing and grubbing, excavation, fill, grading, and the construction of drainage, culverts, and protective structures. (Minor items such as traffic services, improved shoulders, and roadside development are also included in this account.)

2. *Low-type surfacing* includes costs of roadway surface and base for soil-surfaced and gravel roads.

3. *Intermediate-type surfacing* includes costs of roadway surface and base for bituminous surface-treated and mixed bituminous roads.

4. *High-type surfacing* includes costs of roadway surface and base for bituminous penetration, bituminous concrete, sheet or rock asphalt, portland-cement concrete, and brick and block roads.

5. *Structures* includes costs of excavation for construction of bridges and approach structures, and construction of bridges (over 20-ft. clear span), viaducts, grade-separation structures, and tunnels.

Numerous sources of data were investigated to obtain a basis for breaking down the expenditures into the fixed-asset accounts. Basic statistics involved in the Bureau of Public Roads' price index were reviewed; certain mileage and construction-cost tabulations developed in the road-life-study phase of the highway-planning surveys were studied; project records on federal-aid primary, secondary, and urban construction contracts were analyzed; state-highway-needs studies and the estimates of needs of the federal-aid systems made by the American Association of State Highway Officials were examined[4]; and numerous other reports and sources of information, including reports by the Bureau of Public Roads[5] and annual reports of state highway departments, were inspected.

It is apparent that considerable variation existed among the states, by years within the same state, and between road systems. It

[3] There are no price-index trends for local roads and city streets suitable for purposes of this analysis. The price-level adjustment made in this report must, therefore, be considered as approximate. Price-index values vary between states, between road systems, between fixed assets (grading, surfacing, structures, etc.) within each road system, and between individual items included in each fixed asset. There are no statistics now available which can be used to effect a precise conversion of all actual expenditures from one base period to another. Although subindexes for excavation, surfacing, and bridges have been determined for federal-aid highway construction, the possible refinement obtained by applying these subindexes would be small. In fact it might be open to considerable question in the case of local roads and city streets where the composition of the subindexes varies from those for federal-aid work. Use of the composite index appeared, therefore, to be the most practical method of making the price level adjustment, particularly in view of the number of approximations necessary throughout other steps in the analysis.

[4] Hearings before the Committee on Public Works, House of Representatives, 81st Congress, Second Session, February 28 to March 22, 1950, on Federal Aid Highway Act of 1950, pages 275 to 286.

[5] *Highway Needs of the National Defense*, House Document No. 249, June 30, 1949; also *The Local Rural Road Problem*, a report by the Bureau of Public Roads, Department of Commerce, January 1950.

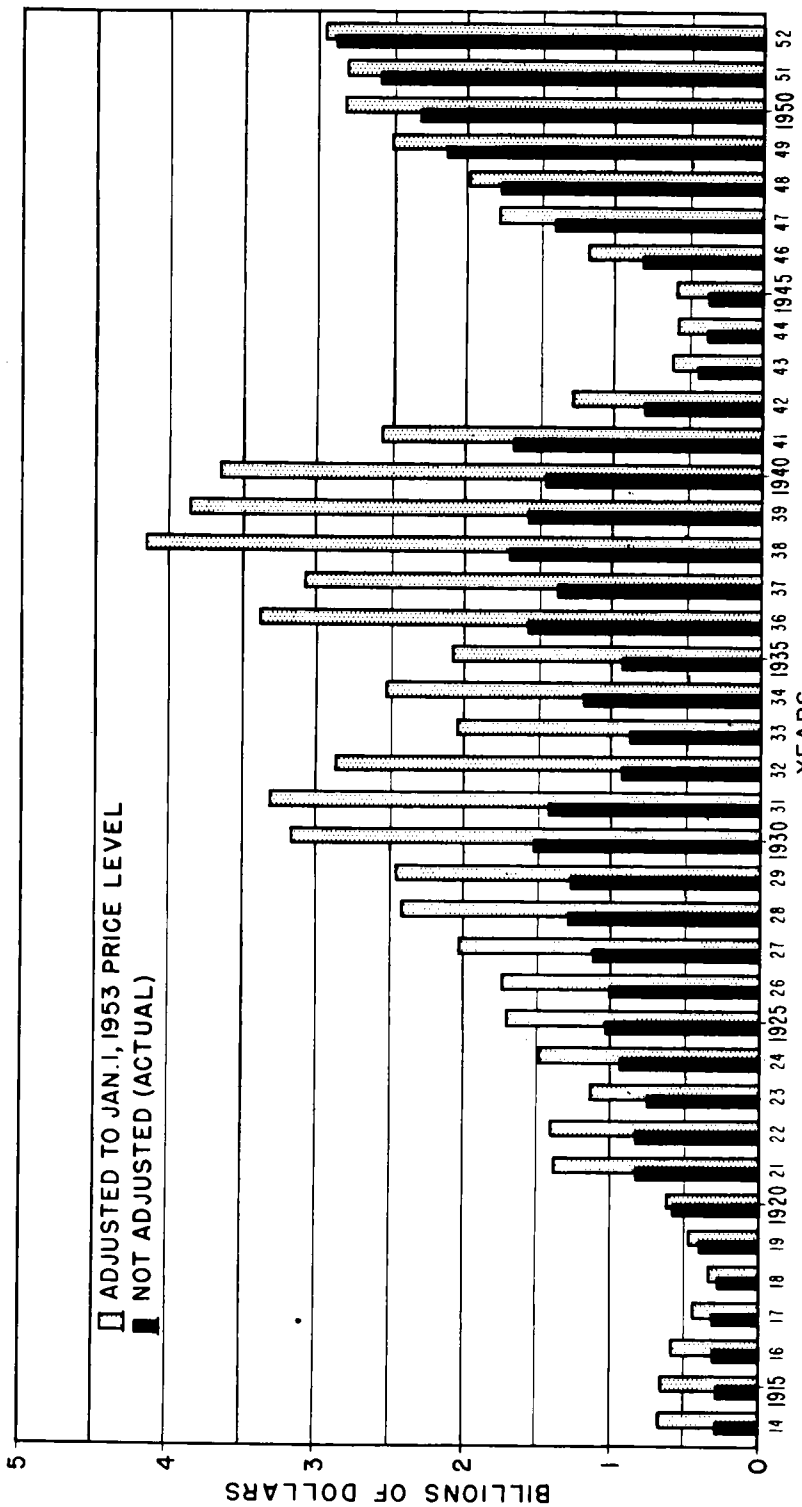

Figure 1. Construction expenditures for all roads and streets in the United States, 1914 to 1952.

would serve no useful purpose to discuss at length the relatively meager information that was assembled from the many sources. Final decisions as to the factors to use in breaking down the expenditures into the five fixed assets are admittedly somewhat arbitrary. They have been made only for the purpose of introducing a refinement which was considered justifiable in view of other more-serious problems that would have been encountered later in the analysis if this particular step were omitted.

In Table 2 are listed the percentage factors as finally determined. Application of these percentages to the appropriate expenditures in Columns 5 to 7 of Table 1 results in an array of construction expenditures for each fixed asset account, year by year, for each principal road and street system. Accumulated total expenditures, 1914 to 1952, for all road and street systems, combined, for the selected fixed asset accounts are as follows:

Fixed asset account	Total construction expenditure, 1914 to 1952, at January 1, 1953 prices
	billion dollars
Grading	21.0
Low-type surfacing	6.6
Intermediate-type surfacing	7.8
High-type surfacing	26.6
Structures	13.5
Total	75.5

INVESTMENT SERVICE LIFE

To determine what proportions of the accumulated expenditures are still in service, as well as other facts concerning age, expectancy, and depreciation of the existing investment, certain information is necessary concerning the service life of the highway investment. In the road-life studies of the highway-planning surveys, considerable data have been developed with respect to service lives of various surface types on a mileage basis for primary rural highways.[6] Unfortunately, however, data with respect to the life of dollars invested in various elements of the highway are quite limited. In fact, the best data available were developed in an unpublished analysis made by the Bureau of Public Roads in 1950 on about $1.2 billion of construction on the state primary rural systems of Kentucky, Missouri, Tennessee, Texas (10 percent of system only), West Virginia, and Wisconsin.[7] From this study, average service lives of dollars invested in highway construction were obtained for each year from 1914. Lives of dollars invested in various elements of the highway are summarized for various periods of years in Table 3.

TABLE 2
APPROXIMATE PERCENTAGE DISTRIBUTION OF CONSTRUCTION EXPENDITURES BY FIXED ASSETS FOR VARIOUS PERIODS OF YEARS[a]

Road System	Fixed Asset	Percentage Distribution by Periods		
		1914–1920	1921–1946	1947–1952
Rural state primary and secondary	Grading	26.9	27.4	26.5
	Low-type surfacing	23.5	7.8	0.8
	Intermediate-type surfacing	13.6	8.3	11.7
	High-type surfacing	22.5	37.9	39.5
	Structures	13.5	18.6	21.5
	Total	100.0	100.0	100.0
County, local, and other rural roads	Grading	31.0	40.9	34.4
	Low-type surfacing	41.7	19.9	15.8
	Intermediate-type surfacing	3.2	9.6	16.0
	High-type surfacing	8.0	10.7	12.8
	Structures	16.1	18.9	21.0
	Total	100.0	100.0	100.0
All urban streets	Grading	25.0	20.0	19.9
	Low-type surfacing	14.7	3.2	1.0
	Intermediate-type surfacing	8.2	11.4	15.0
	High-type surfacing	42.1	50.4	46.1
	Structures	10.0	15.0	18.0
	Total	100.0	100.0	100.0

[a] The entries in this table are shown to the nearest 0.1 percent but should not be presumed accurate to this extent (see text).

TABLE 3
AVERAGE SERVICE LIFE, IN YEARS TO ZERO SALVAGE, OF CAPITAL OUTLAY FOR VARIOUS FIXED ASSETS ON PRIMARY RURAL HIGHWAYS FOR VARIOUS PERIODS OF YEARS[a]

Period of Years	Fixed Assets				
	Grading	Surfaces			Structures
		Low	Intermediate	High	
	yr.	*yr.*	*yr.*	*yr.*	*yr.*
1914 to 1919	25	22	26	27	40
1920 to 1929	41	21	22	30	43
1930 to 1939	56	16	20	33	52
1940 to 1949	54	14	19	26	52
1950 to 1952	55	14	20	25	52

[a] Values shown are arithmetic averages of the service life estimates for each year within the respective periods.

[6] "Life Characteristics of Surfaces Constructed on Primary Rural Highways," by Robley Winfrey and Fred B. Farrell, presented at the 20th Annual Meeting, Highway Research Board, December 1940; and "Life Characteristics of Highway Surfaces," by Fred B. Farrell and Henry R. Paterick, presented at the 28th Annual Meeting, Highway Research Board, December 1948.

[7] Basic data used in this 1950 analysis were developed as part of the road life study phase of the highway-planning surveys in these states.

Mechanics of developing the service lives are similar to those outlined in the previously mentioned reports except that dollars, instead of miles, are used in the analysis. Estimates, thus developed, take into account actual experience and therefore reflect the composite effect of all factors contributing to retirements: structural failure, obsolescence, funds available to do needed work, and so on. For the more-recent years, the amount of retirements is frequently insufficient to give a reliable indication of the service life. In such instances, past trends and judgment were used to fill the gaps.

With respect to service lives of the dollars involved in construction of local roads and city streets, data are extremely meager. Neither is there any appreciable evidence concerning differences between investment service life values for fixed assets on primary rural roads and those for local roads and city streets. Accordingly, the service life values in Table 3, as developed for primary rural roads, were used for all road and street systems.[8]

[8] Inasmuch as application of retirement rates for each fixed asset is made in accordance with the distributions shown for each road system in Table 2, it is likely that better knowledge of the differences by systems in investment life values for each fixed asset would result in only relatively small changes in the final results. Following are brief comments on factors which affect service lives of fixed assets:

Grading. The location of most local roads and city streets is more or less permanent. However, many items included in the grading account are undergoing constant change. On local roads, improvements are continually being made by providing better drainage, widening, and eliminating excessive grades and curves. Lack of adequate maintenance (a common occurrence on local roads) frequently results in conditions which require construction to overcome the deficiencies which have developed. On city streets any work other than resurfacing usually involves loss of prior work such as curb and gutter, sidewalks, drainage systems, and retaining walls. Thus for both local roads and city streets prior work is constantly being retired through the continuous process of rehabilitation and improvement. Estimates of average life of grading as shown in Table 3 are, therefore, considered reasonable for local roads and city streets.

Surfacing. As indicated in Table 2, construction expenditures for surfacing have been greatest for low types on local roads and for high types on city streets. For low types, the service lives indicated in Table 3 appear reasonable as an average for each road system; for high types they may appear somewhat low for city streets at first glance. However, the lives shown are averages, and it is to be expected that many high types will give service for many years in excess of the average. The past three to four decades have witnessed substantial amounts of resurfacing and widening of city streets. It would be erroneous to pyramid these capital outlays on the assumption that all prior work enjoys substantially full salvage at the time of resurfacing or reconstruction. Thus, until further research reveals facts that warrant assignment of longer investment lives for city streets, it was considered preferable for purposes of this report to use those developed for comparable types on primary rural highways.

Structures. Structures, whether on local roads, city streets, or primary highways have a considerable life span. The use of service life data for structures on primary roads appears reasonable for local roads and city streets.

From the analysis of the previously mentioned $1.2 billion of construction, the retirement rates of dollars at various years after construction were obtained for each fixed asset. These retirement rates, corresponding to the service lives in Table 3, were then applied to the expenditure for each fixed asset for each road system. From this computation, the dollars retired for each fixed asset and each road system were totaled for each year up to 1952. Retirements were then accumulated from 1914 and deducted from the accumulated construction expenditures. Figure 2 illustrates the net result, graphically.

The upper line in Figure 2 represents the accumulation of all construction expenditures through 1952, as obtained from Column 4 in Table 1. With the exception of World War II, the trend shows a sustained rise to a total of $75.5 billion as of January 1, 1953. The lower line in Figure 2 represents construction dollars remaining in service after deducting dollars which were lost through road abandonments or which were not salvaged for further use in the road or street as rebuilt. As of January 1, 1953, therefore, there are $60.7 billion still in service out of the original $75.5 billion, indicating a net retirement of $14.8 billion, or about 20 percent of the original construction expenditures.

Breakdown of the $60.7 billion by principal road systems is as follows:

Road system	Amounts remaining in service on January 1, 1953
	billion dollars
Rural state primary and secondary	28.0
County, local, and other rural roads	14.9
All urban streets	17.8
Total	60.7

With respect to amounts remaining in service for each fixed asset, the computations were made in such manner as to retain the identity of the fixed asset for which the construction expenditure was originally made. Thus, an expenditure made for a low-type surface is permanently retained in the fixed-asset account for low types, even though it might later have been salvaged as part of a higher type surface through the processes of resurfacing or reconstruction. Distribution of

the amounts remaining in service on January 1, 1953 for each fixed asset is as follows:

Fixed asset for which construction expenditure was originally made	Amounts remaining in service on January 1, 1953
	billion dollars
Grading	18.8
Low-type surfacing	2.6
Intermediate-type surfacing	5.0
High-type surfacing	21.8
Structures	12.5
Total	60.7

A comparison of the foregoing amounts with the previously cited total construction expenditures reveals that percentages of capital outlay since 1914 which are still in service on January 1, 1953 are least for low-type surfacing and highest for structures. Caution must be exercised in the use of these detailed statistics in view of the general assumptions and estimates that were necessary. As better basic data become available, greater reliability will result.

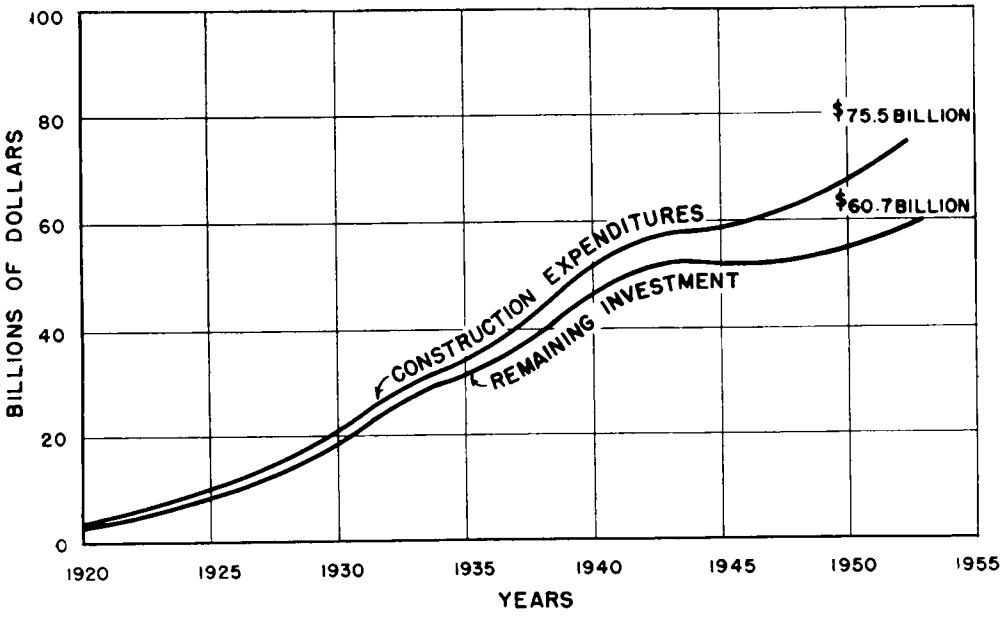

Figure 2. Accumulated construction expenditures and remaining investment through 1952. (January 1, 1953, prices for construction since 1914 on all roads and streets in the United States.)

DEPRECIATION

Of the total years of service which were built into each road and street at the time of its original construction or reconstruction, a considerable portion has been consumed, and this portion is increasing as time goes on. Figure 3 shows the trend in average age and life expectancy of the capital investment in service on January 1 of each year from 1921 to 1953 for all roads and streets, combined. Solid portions show average age of construction dollars remaining in service; stippled portions represent average remaining years of service life, or expectancy. Total height of each bar represents probable average service life of the dollars in service. It will be observed that average age has been increasing over the years and, for the most part, average expectancy has been decreasing. As of January 1, 1953, average age is nearly 15 yr. and average expectancy is about 28 yr.[9] Values for individual major road systems as of January 1, 1953, are shown in Table 4; those for fixed assets are shown in Table 5.

Thus, dollars remaining in service are not brand new; they have been aging, and a sub-

[9] At zero age, the average service life of the investment is a composite average of numerous portions having different service lives. As the investment becomes older, those portions with the shorter lives are retired; consequently the age plus the expectancy of those portions remaining in service will be greater than the average service life of all portions at zero age.

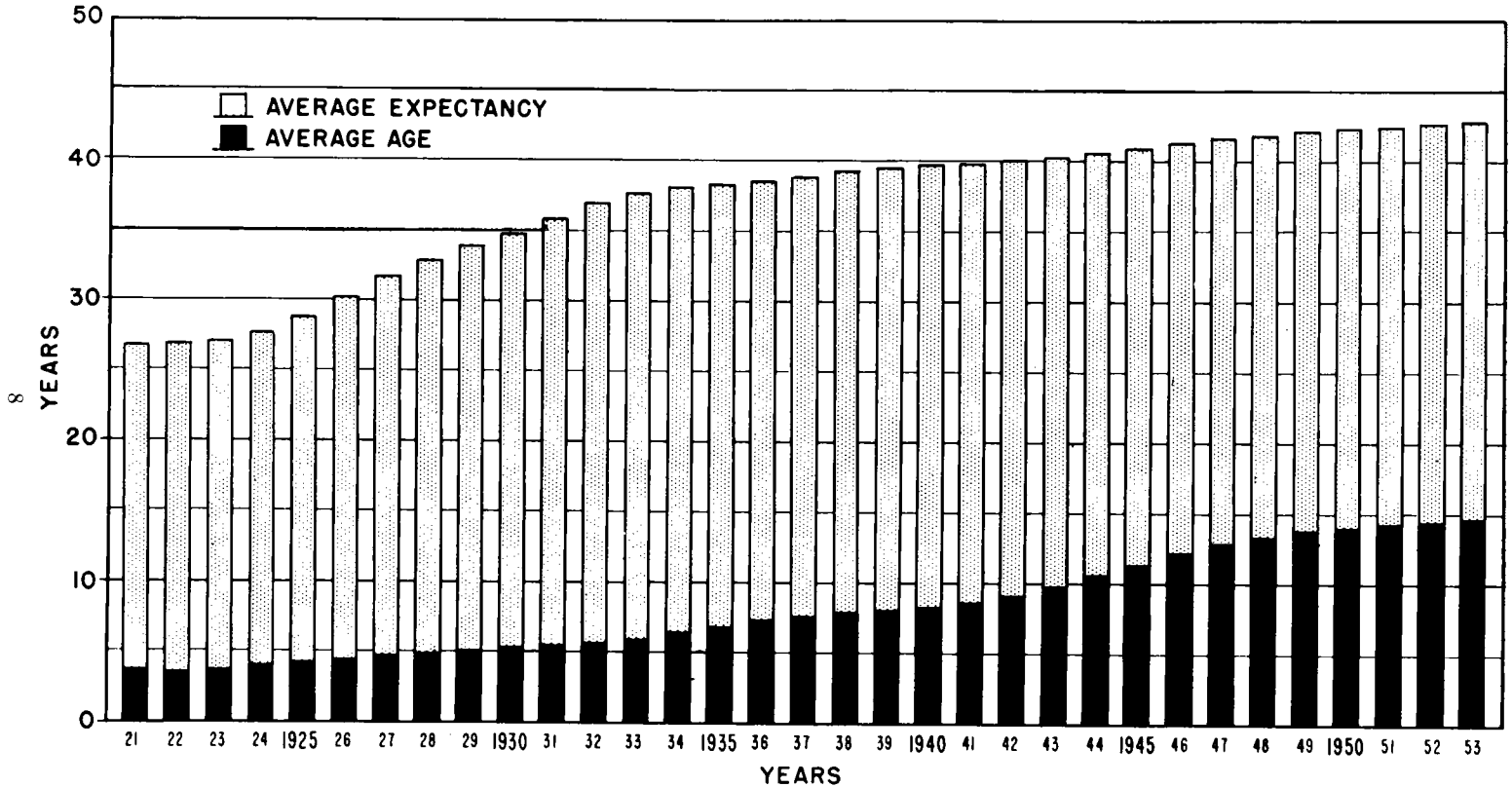

Figure 3. Average age and expectancy of all capital invested in highways.

TABLE 4

AVERAGE AGE AND EXPECTANCY OF CONSTRUCTION DOLLARS REMAINING IN SERVICE AS OF JANUARY 1, 1953 FOR PRINCIPAL ROAD SYSTEMS

Road System	Average Age	Average Expectancy
	yr.	*yr.*
Rural state primary and secondary	14.4	28.4
County, local, and other rural roads	13.8	31.2
All urban streets	15.5	25.4
All systems	14.6	28.2

TABLE 5

AVERAGE AGE AND EXPECTANCY OF CONSTRUCTION DOLLARS REMAINING IN SERVICE AS OF JANUARY 1, 1953 FOR PRINCIPAL FIXED ASSETS

Fixed Asset	Average Age	Average Expectancy
	yr.	*yr.*
Grading	15.1	40.4
Low-type surfacing	15.1	8.3
Intermediate-type surfacing	11.7	11.7
High-type surfacing	14.5	18.4
Structures	15.0	37.7
All fixed assets	14.6	28.2

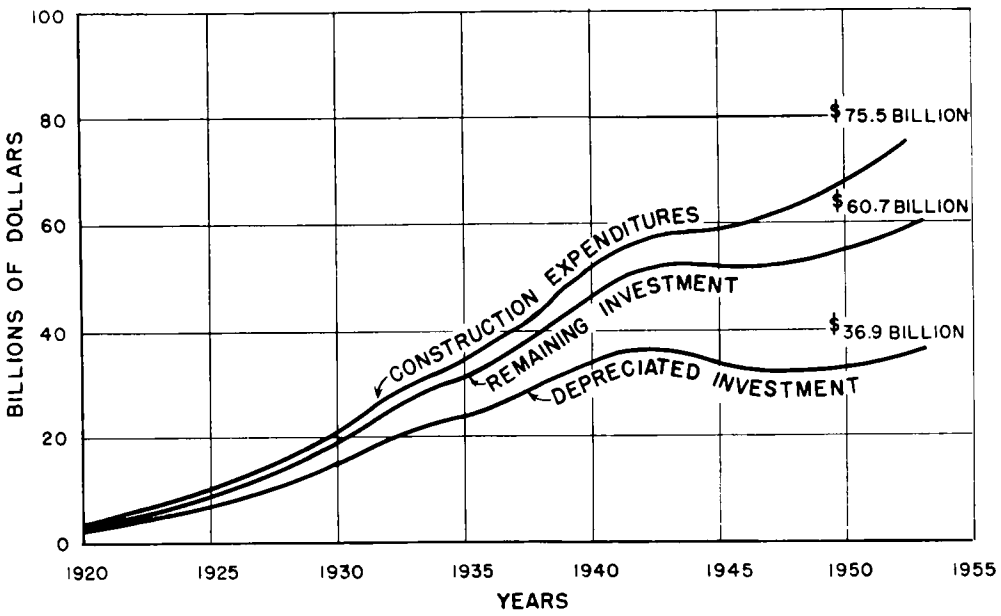

Figure 4. Accumulated construction expenditures, remaining investment, and depreciated investment through 1952.

stantial portion of their probable life has been consumed. They have lost some of their usefulness; in other words, they have experienced depreciation. This depreciation can be readily computed employing the unit-summation method for group properties as outlined in Bulletin 155 of the Iowa Engineering Experiment Station.[10]

In Figure 4 are shown three trend lines. The upper two are identical with those in Figure 2 and indicate accumulated construction expenditures and dollars remaining in service Unconsumed or depreciated investment from January 1, 1920, to January 1, 1953, is shown by the lower trend line in Figure 4. For any given year the vertical difference between the two lower lines represents the total amount of depreciation which has taken place. Thus, up to January 1, 1953, a total of $75.5 billion has been spent for construction of all roads and streets. After deducting retirements, $60.7 billion of this amount are still in service; and of this $60.7 billion, there is an unconsumed or depreciated investment of $36.9 billion. Composition of the $36.9 billion by principal road systems is as follows:

[10] Bulletin 155, "Depreciation of Group Properties," dated June 3, 1942, by Robley Winfrey, Iowa Engineering Experiment Station, Iowa State College. In the computations presented in this report, a zero interest rate was used.

Road system	Depreciated investment as of January 1, 1953
	billion dollars
Rural state primary and secondary	17.3
County, local, and other rural roads	9.4
All urban streets	10.2
Total	36.9

Distribution of the depreciated investment as of January 1, 1953 for the selected fixed assets is shown in the following listing:

Fixed asset for which construction expenditure was originally made	Depreciated investment as of January 1, 1953
	billion dollars
Grading	12.8
Low-type surfacing	1.0
Intermediate-type surfacing	2.6
High-type surfacing	12.0
Structures	8.5
Total	36.9

The trend for accumulated dollars remaining in service (the middle line in Figure 4) has been upward. During the war years it leveled off, following which it continued upward but at a lesser rate than in the prewar period. In recent years, this rate has been noticeably affected by the increasingly larger amounts of retirement of worn-out roads that are being experienced. The bottom line in Figure 4, representing the trend in depreciated investment, shows a dip during World War II. This results from the fact that new construction during this period was insufficient to meet the depreciation taking place. The decrease was of such proportions that the 7 yr. of highway construction in the postwar period have been sufficient only to restore the depreciated investment to the 1941 level.

It is of interest, too, to compare construction expenditures and investment data for the seven postwar years with other selected seven-year periods. Such a comparison is shown in Table 6. World War II years, 1942 to 1945, were excluded and the comparison made for the 7-yr. periods 1921–27, 1928–34, 1935–41, and 1946–52.

Of several methods considered with respect to presenting the comparison, that of showing expenditures and investment on the basis of motor-vehicle registrations appeared to be the least complicated and most-easily interpreted.

Entries in Table 6 show, for example, that construction expenditures per registered motor vehicle ranged from $91 to $108 in the three 7-yr. pre-World War II periods and then fell off markedly to about half of these amounts in the 7-yr. postwar period. Although quite significant by itself, this fact tells only part of the story.

In the first place, construction expenditures during a given period exceed the total net gain in investment. As previously mentioned,

TABLE 6

HIGHWAY CONSTRUCTION EXPENDITURES AND INVESTMENT PER REGISTERED MOTOR VEHICLE FOR SELECTED 7-YR. PERIODS

Item	Seven-Yr. Period (Excluding World War II)			
	1921–27	1928–34	1935–41	1946–52
Motor-vehicle registrations[a]				
Annual average for period (millions)	17.2	25.2	30.1	44.6
During last year of period (millions)	23.1	25.0	34.5	53.4
Construction expenditures[b]				
Annual average for period (millions)	$1,563	$2,690	$3,258	$2,296
Annual average per registered motor vehicle during period	$91	$107	$108	$51
Total remaining investment, undepreciated[c]				
At end of period (billions)	$14.3	$31.8	$51.5	$60.7
Amount per registered motor vehicle at end of period	$619	$1,272	$1,493	$1,137
Total remaining investment, depreciated				
At end of period (billions)	$11.3	$24.1	$36.7	$36.9
Amount per registered motor vehicle at end of period	$489	$964	$1,064	$691

[a] Table MV-1 and MV-201, "Highway Statistics," published by Bureau of Public Roads.
[b] From Table 1 (adjusted to January 1, 1953, price level).
[c] Accumulated construction expenditures less retirements.

certain portions of prior improvements are constantly being retired and taken out of service during the continuous process of rebuilding and modernizing inadequate and worn-out roads. This was shown graphically by the increasing spread between the two upper lines in Figure 4. As might be expected, retirements were smaller in the earlier periods when roads were relatively new. When the remaining investment, undepreciated, at the end of each of the 7-yr. periods is divided by the registrations at the end of the same period, it is found that there has been a relatively steady increase over the years up to a value of $1,493 per registered motor vehicle at the end of 1941.

Since World War II, this amount has fallen off to $1,137 per registered motor vehicle at the end of 1952.

In order to complete the picture, however, an additional factor, that of depreciation, must be taken into account. Roads and streets remaining in service during each successive period are getting older, and their service usefulness is constantly being consumed. This is shown graphically by the trend of the bottom line on Figure 4. After deducting depreciation, it is found, as shown in Table 6, that the depreciated investment per registered motor vehicle increased steadily up to $1,064 by the end of 1941, but by the end of 1952 it had fallen off to $691.

CONCLUSION

At the January 1, 1953, price level, $75.5 billion have been spent on the construction of highways, roads, and streets in the United States during the period 1914 to 1952.

★ Of this amount, $60.7 billion still remain in service on January 1, 1953.

★ This $60.7 billion investment is 14.6 yr. old.

★ It has depreciated $23.8 billion by January 1, 1953.

★ The depreciated investment per registered motor vehicle was $1,064 at the end of 1941.

★ On January 1, 1953, the depreciated investment per registered motor vehicle was only $691.

These are significant findings. When appraised in the light of other findings concerning the rate of development of the highway plant, they can be used as positive indicators of whether ground is being gained or lost. Facts concerning age, depreciation, rates of growth, and so on, are essential to an understanding of just what is being accomplished by the current highway program and to a determination of the extent to which the service potential of highway systems will be affected by various future program alternatives. More such facts are needed. However, the most effective applications of analyses of this type will result when they are made by individual states. The highway-planning surveys, in particular, contain a wealth of detailed data for testing the validity of many possible relationships and aiding in the interpretation of the findings of the many types of engineering, road cost, and economic studies so essential to sound highway planning and programing.