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NEEDS OF THE HIGHWAY SYSTEMS, 1955-84

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LETTER

FROM

SECRETARY OF COMMERCE

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A REPORT ON THE COST OF CONSTRUCTION NEEDED TO MODERNIZE THE NATION'S HIGHWAYS, PREPARED BY THE COMMISSIONER OF PUBLIC ROADS IN COOPERATION WITH THE SEVERAL STATE HIGHWAY DEPARTMENTS, AND A STATEMENT ON HIGHWAY FINANCING, PURSUANT TO SECTION 13 OF THE FEDERAL-AID HIGHWAY ACT OF 1954, APPROVED MAY 6, 1954



MARCH 28, 1955.—Referred to the Committee on Public Works and ordered to be printed with illustrations

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LETTER OF TRANSMITTAL

THE SECRETARY OF COMMERCE,
Washington 25, March 25, 1955.

HON. SAM RAYBURN,
Speaker of the House,
House of Representatives,
Washington 25, D. C.

MY DEAR MR. SPEAKER: I transmit herewith a report on the cost of construction needed to modernize the Nation's highways, prepared by the Commissioner of Public Roads in cooperation with the several State highway departments, and a statement on highway financing.

The report has been prepared pursuant to a direction of the Congress contained in section 13 of the Federal-Aid Highway Act of 1954, approved May 6, 1954, quoted as follows:

SEC. 13. The Secretary of Commerce is authorized and directed to make a comprehensive study of all phases of highway financing, including a study of the costs of completing the several systems of highways in the several States and of the progress and feasibility of toll roads with particular attention to the possible effects of such toll roads upon the Federal-aid highway programs, and coordination thereof, and to make a report of his findings, including recommendations with respect to Federal participation in toll roads, to be submitted to the Congress not later than February 1, 1955: *Provided*, That not to exceed \$100,000 from funds available for administrative expenses shall be expended for the purposes of this section.

A further report discussing toll roads and containing recommendations with respect to Federal participation in such roads is practically complete and will be submitted shortly.

The accompanying report shows in detail the very large expenditures required to make the Nation's highways adequate. It is impressive that only through greatly enlarged financial provision can urgent needs for highway transportation be met.

Sincerely yours,

SINCLAIR WEEKS,



Secretary of Commerce.

III

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NEEDS OF THE HIGHWAY SYSTEMS, 1955-84

The cost of needed construction, designed to modernize the Nation's roads and streets over the next 10 years, will amount to \$101 billion, and an additional \$25 billion will be required for highway maintenance and administration.

These are the estimates obtained in a study undertaken in 1954 by the Bureau of Public Roads, with the cooperation of the State highway departments, in accordance with the request of Congress for

* * * a study of the costs of completing the several systems of highways in the several States * * *

INTERPRETATIONS

The intent of the request by the Congress is clear, but the interpretation of the specific wording warrants some discussion.

Continuing needs

It is not possible to "complete" a highway in the sense that it can by a single construction operation be made forever adequate. From the very day that highway facilities are opened to traffic, they begin the course of deterioration and obsolescence that eventually leads to necessary reconstruction or replacement.

Natural forces—heat, cold, and moisture—subject the roads to damaging erosion, freezing and thawing, contraction and expansion. The endlessly repetitive passage of vehicles, particularly those with heavy axle loads, pound away, flexing and fatiguing the surfaces.

The volume of traffic is ever increasing; there is continuous change in the characteristics of the vehicles—their sizes, weights, power, and speed capabilities; new traffic needs develop. Thus in time it becomes necessary to straighten alinements, reduce grades, provide more width, and add new roads.

Individually and in combination these forces operate to make the job of building, improving, and rebuilding highways a continuous process. In this sense, therefore, a highway system is never complete.

Basis of needs

The term "needs" likewise requires explanation. It is a word widely used in recent years to denote construction backlog. Amounts cited as "needs" sometimes refer to the cost of complete modernization as of a given moment; sometimes they cover a construction program stretching over a period of years.

Some estimates are based on the needs of current traffic; others take future traffic fully into account.

There are variations, too, in the specifications of design standards, and there are differences in their application—one study may permit no deviations, while another will accept large deviations or tolerances.

Advance decision as to financial feasibility of meeting needs has also been an influence in some needs studies. Such an adjustment, in the interest of producing a "realistic" estimate of needs, should be made *after* the estimate has been derived. It should not be made by arbitrary reduction of standards or other means beforehand.

STUDIES IN RECENT YEARS

To greater or lesser degree the foregoing factors have been involved in the estimates of needs developed both statewide and nationwide in recent years. It is important that this be clearly understood, lest erroneous conclusions be drawn when making general comparisons.

Provision of adequate highways has never been abreast of demand. Needs were mounting prior to World War II. During the war, curtailment of construction resulted in a further lag. Since 1946 traffic has increased with each succeeding year, but highway construction has not kept pace.

In needs studies made during the immediate postwar period (1946-50), the rapid increase in highway usage was viewed by many as a temporary phenomenon—a leveling-off was anticipated in the predictable future. Even so, estimates of needs showed construction requirements of great magnitude.

Since then, economic studies based on the wealth of data made available by the 1950 census have indicated that other elements of the Nation's economy were also enjoying vigorous growth patterns, and that they are likely to so continue. It has become evident that the continuing increase of highway travel is not an isolated trend.

The shortage of current revenues for highways existing since 1946, in the face of needs known to be large, has posed a dilemma to highway agencies. On the one hand there is the basically sound policy of putting as much money as possible into high-type improvements with long service lives—a policy that generates dissatisfaction when badly needed improvement of some roads is held in abeyance while a substantial portion of available funds is concentrated on other roads.

The alternative is an across-the-board "make-do" program, characterized by short-term, stopgap work done in lieu of needed major improvements. Such programs provide temporary relief rather than cures for the problem; they rarely reduce the ultimate need for large-scale improvement.

INITIATION OF STUDY

By 1954, when Congress requested an estimate of highway needs, a large body of fact was available to the States, and the technique for making such an estimate had advanced materially. The Bureau of Public Roads sought the cooperation of the 48 States, the District of Columbia, Hawaii, and Puerto Rico, and the basic estimates of needs and costs presented in this report represent the data furnished by them.

It is recognized that some tendency to understate needs still exists. Lack of full supporting evidence of need may cause the paring down of estimates to the point where they cannot be questioned; this is probably true in greater degree in the estimates for urban areas. Additionally, the true needs in many cities are exceedingly great in

relation to current prospects of meeting them, and there is a tendency toward understatement in the interest of producing an estimate that reflects financial feasibility rather than anticipated needs.

Relatively minor differences occurred among the States in the interpretation of and adherence to the concepts and guides established for this study. These account for a certain lack of uniformity in the reported information. Nevertheless, the totals are deemed wholly adequate as a representation of nationwide needs, forming a basis for setting the initial course of remedial action.

Systems studied

The States were asked to furnish estimates of needs for all roads and streets, segregated by systems as follows:

Federal-aid systems:

1. Interstate, rural
2. Interstate, urban
3. Other Federal-aid primary, rural
4. Other Federal-aid primary, urban
5. Federal-aid secondary, under State control
6. Federal-aid secondary, under local control

Non-Federal-aid systems:

7. Other State highways, rural
8. Other State highways, urban
9. Other rural roads
10. Other city streets

Existing and programed toll roads were included in the systems deemed most logical from the standpoint of traffic service.

All costs were estimated at midyear 1954 prices. Construction cost estimates include an allowance for engineering and contingencies.

The estimates also include costs for Federal road systems (forest highway system, national park road system, national parkways, Indian reservation roads, and forest development roads). These have not been itemized individually. Many portions of these Federal systems are also in one or another of the above listed systems; those portions wholly Federal (no other governmental jurisdiction involved) are included with other rural roads and city streets.

The rural-urban classification used for systems 1-4 is that prescribed by Federal-aid legislation: Urban mileage is that in areas including and adjacent to municipalities or other urban places of 5,000 population or more. For systems 5 and 6, the mileage is almost wholly rural (outside the urban areas just described). It does include mileage without reference to municipal boundaries in the District of Columbia, Puerto Rico, and 7 States where population density exceeds 200 persons per square mile.

For the non-Federal-aid systems (7-10), the States followed their individual practices in classifying mileage as rural or urban.

It should be noted that some differences exist in mileages cited in this study and mileages previously reported in other publications by the Bureau of Public Roads. Some of these differences result from differences in rural-urban and system segregations; some, particularly in the figures for local roads and streets, are accounted for by the fact that the States have made new estimates. All of the mileages cited in this report are those reported by the States in connection with the needs study.

Periods covered

The estimates presented in this report cover two periods:

First 10 years, 1955-64.—Estimates were prepared to provide that each road system will be improved, by the end of 1964, to a condition adequate for its predicted traffic in 1964 (1974 in the case of the interstate system).

Next 20 years, 1965-84.—On the assumption that adequacy will be reached in 1964, estimates were prepared to provide for sustaining adequacy thereafter. The States supplied these estimates for the 20 years, 1965-84.

SYSTEM IMPROVEMENT

One of the principal objectives of the needs study was to develop costs that are realistic estimates of needs, unaffected by preconceptions of ability to finance or execute a program. The proposed development of the various road systems is described briefly in the following paragraphs.

Interstate system

1955-64.—During the first 10 years the concept of development for the interstate system contemplates improvement of the entire system so that by the end of the period every road section will be structurally adequate, will have lane width sufficient to carry traffic predicted for 1974, and will otherwise be adequate for 30 to 40 years from the date of its construction.

1965-84.—The system is to be kept in continuing sound structural and functional condition after 1964. After 1974 additional lanes will be built as traffic needs warrant.

Other Federal-aid primary

1955-64.—The concept of development for the Federal-aid primary system (exclusive of the interstate system) for the first 10 years is to provide improvements so that the system will, by the end of 1964, be adequate for traffic of that year. Any road section improved during this period shall have a generally high-type surface, a sufficient number of lanes to take care of traffic for 10 years, and adequacy in other geometric respects for 30 years from the date of its construction.

1965-84.—As road sections become inadequate structurally or functionally, after 1964, they shall be rebuilt in accordance with a continuation of the concept for the first 10 years.

All other systems

1955-64.—For the more important and heavily traveled roads and streets of all other systems, the 1955-64 improvement contemplated is similar to that for the "other Federal-aid primary," except that shorter service lives and lower type surfaces may be used. For the less important and lightly traveled roads and streets, the need is generally one of providing locally acceptable traffic service.

1965-84.—After 1964, all roads and streets shall be kept adequate in accordance with continuation of the concept for the first 10 years.

Design standards

When a road or street is to be improved, the new construction should conform to certain requirements for width, alinement, grade, and so on. These requirements are called geometric design standards.

In preparing the cost estimates of needed improvements for this study the highest design standards were, of course, used for the interstate system. Progressively lower standards were used for each road system of lesser importance. In general, the design standards used in making the cost estimates are in accord with those adopted by the States.

For the interstate system the concept is one of improvement so that the entire system will, by 1964, be structurally and functionally adequate, with all the essential features of a well-designed road capable of handling 1974 traffic. This implies substantial rebuilding during the first 10 years.

For other principal road and street systems, determination of sections needing rebuilding by 1964 was based on the acceptability of tolerable conditions—under which roads and streets can be considered acceptable even though they may not measure up to the design standard. Such roads and streets would be kept in service until they were no longer judged as being adequate even by the measure of tolerable conditions.

For example, an adequate design for an anticipated traffic volume of 3,000 vehicles per day in 1964 might call for a 24-foot width of surface, 10-foot shoulders, a maximum grade of 5 percent, and a maximum curvature of 5 degrees; but the existing road would be considered tolerable with respect to these features if it had a 20-foot surfaced width, 6-foot shoulders, a maximum grade of 6 percent, and a maximum curvature of 9 degrees.

Similar criteria with respect to other features were employed as an aid in determining the extent of needed work to overcome deficiencies. The procedure is in general conformity with the practices employed by the States in recent years in estimating highway needs.

For local roads and city streets, the conditions of tolerability were much more flexible. Considerable weight was given to established local practices and policies. For example, there were many cases where no estimate of needs was made as long as a road was considered passable and as long as the users would accept the condition as tolerable.

CONSTRUCTION NEEDS, 1955-64

Estimates of construction needs (including right-of-way costs), summarized herein for the 10-year period 1955-64, were prepared by each State, the District of Columbia, Hawaii, and Puerto Rico. A number of States submitted revised estimates, a few of which were received too late to include in the final compilations of summary data. The totals reported by each State for each road system are listed in table 1, and nationwide totals are summarized in table 2. A graphic comparison of the 10-year construction needs, 1955-64, and the estimated 1965 mileages, by system, is shown in figure 1.

NEEDS OF THE HIGHWAY SYSTEMS, 1955-84

TABLE 1.—Highway construction needs, 1955-64 by system and State

[All amounts in millions of dollars 1]

State	Federal-aid systems										Non-Federal-aid systems						All roads and streets							
	Interstate			Other Federal-aid primary			Federal-aid secondary		Total		Other State highways			Other roads and streets			Total		Rural	Urban	Total			
	Rural	Total		Rural	Total		Local	Total	Rural	Total		Rural	Total		Rural	Total								
		Urban	Rural		Urban	Rural				Urban	Rural		Urban	Rural		Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	
Alabama.....	316	50	366	139	153	292	23	111	134	580	792	2	11	13	780	469	1,249	782	480	1,262	1,371	682	2,054	
Arizona.....	193	17	210	123	132	255	94	143	143	456	59	485	5	15	195	36	171	171	36	171	171	65	236	
Kansas.....	349	32	381	223	25	249	271	78	349	743	58	801	10	10	107	161	298	298	117	166	283	890	294	
California.....	592	1,729	2,321	859	677	1,536	367	288	648	2,090	4,505	351	423	774	1,385	1,545	2,930	1,736	1,968	3,898	3,898	4,374	8,272	
Colorado.....	130	27	157	321	67	388	107	618	107	618	87	735	6	6	173	236	700	436	236	3,714	1,157	3,223	4,381	
Connecticut.....	185	21	206	227	585	812	166	41	207	630	757	380	144	373	147	143	301	368	288	674	1,151	1,039	2,190	
Delaware.....	35	21	56	81	26	107	82	4	207	299	47	256	29	30	0	13	92	97	52	62	246	246	308	
Florida.....	350	130	480	107	724	831	242	74	316	783	860	1,643	62	158	220	194	43	167	184	201	887	1,091	2,078	
Georgia.....	593	130	723	700	467	1,167	641	178	166	355	1,291	696	56	31	87	268	206	474	394	237	887	1,753	2,640	
Illinois.....	545	518	1,063	726	256	982	31	362	139	412	774	2,186	293	182	405	439	1,447	1,886	1,622	1,622	2,902	2,704	5,606	
Indiana.....	475	302	777	876	304	1,179	385	514	514	1,712	695	2,763	18	33	51	741	681	1,422	768	133	1,473	2,707	4,180	
Indiana.....	220	16	236	975	96	1,071	112	314	314	1,157	112	1,87	3	1	4	277	198	477	277	198	477	1,059	1,536	
Iowa.....	363	199	562	402	329	731	107	416	70	495	215	1,574	215	71	286	108	169	177	323	140	473	332	805	
Kentucky.....	246	247	493	359	176	535	457	416	79	664	320	984	215	56	271	266	241	307	381	297	578	848	617	1,425
Louisiana.....	155	270	424	212	284	496	201	140	259	409	133	632	105	14	98	210	301	308	103	204	554	1,266	1,823	
Maine.....	135	694	829	240	285	525	94	318	419	826	563	1,382	6	3	12	361	901	902	204	204	574	1,266	1,823	
Massachusetts.....	807	488	1,295	385	440	825	532	116	1,295	700	928	1,368	57	105	162	655	1,406	2,151	712	941	2,313	4,424	6,737	
Michigan.....	252	221	473	305	383	688	113	116	417	1,257	410	2,050	2	5	21	128	498	236	214	274	244	694	959	
Minnesota.....	222	24	246	500	33	533	80	47	177	619	57	750	17	4	3	20	497	717	312	435	247	754	1,000	
Mississippi.....	456	168	624	649	178	827	308	47	308	1,413	1,784	22	8	30	170	25	105	105	286	326	1,755	713	2,468	
Missouri.....	141	12	153	347	4	351	112	79	79	357	47	553	22	2	1	170	161	332	168	168	332	613	925	
Montana.....	80	10	90	178	149	327	112	21	109	185	47	465	2	2	2	46	83	129	113	91	904	322	282	
Nebraska.....	42	24	66	159	45	204	62	2	84	187	60	314	67	8	72	46	83	129	113	91	904	322	282	
New Hampshire.....	223	1,134	1,357	625	1,081	1,706	117	282	247	1,097	2,219	3,312	22	22	62	344	873	1,219	366	945	1,311	1,468	3,160	
New Jersey.....	616	39	655	201	46	247	117	406	404	105	506	74	23	92	128	108	256	256	151	407	400	562	1,069	
New Mexico.....	638	698	1,336	2,063	3,356	483	406	380	3,356	1,981	5,858	6	15	25	283	553	821	279	571	849	3,869	2,692	6,561	
New York.....	228	21	247	514	42	556	255	68	255	300	838	6	15	21	182	155	367	188	158	107	358	483	233	
North Carolina.....	103	824	927	4	82	830	102	68	47	634	142	3,036	238	82	320	744	886	1,680	1,082	968	2,000	2,064	2,370	
Ohio.....	687	81	768	622	578	1,200	354	118	285	1,035	1,850	2,221	24	13	37	137	251	251	130	318	1,500	3,160	4,660	
Oklahoma.....	296	149	445	319	187	506	73	38	106	463	295	756	4	18	22	182	109	281	186	127	313	649	966	
Oregon.....	370	149	519	187	146	333	73	38	106	463	295	756	4	18	22	182	109	281	186	127	313	649	966	
Pennsylvania.....	800	760	1,560	1,074	482	1,556	1,422	18	1,440	2,874	882	3,756	85	85	1,230	275	708	1,598	360	1,938	4,472	1,242	5,714	

Rhode Island.....	7	116	123	117	128	245	28	10	38	102	244	406	13	11	24	25	31	56	38	42	80	200	286	486
South Carolina.....	140	43	183	141	30	123	72	5	177	310	73	383	79	19	98	79	30	109	158	49	207	468	122	680
South Dakota.....	80	119	850	472	115	687	184	61	245	978	32	416	7	7	7	61	41	102	68	41	109	432	173	525
Tennessee.....	515	357	872	520	135	655	464	13	464	1,499	482	1,991	260	29	289	631	745	1,394	821	267	588	1,299	661	1,800
Texas.....	189	49	258	100	29	129	48	15	63	352	78	430	39	2	41	104	57	161	143	89	202	495	1,264	3,074
Utah.....	169	9	178	167	12	179	46	28	74	410	21	431	2	19	2	35	5	40	37	5	42	447	26	473
Vermont.....	386	183	669	308	139	467	207	21	228	922	342	1,294	1	19	20	283	190	473	234	209	493	1,206	551	1,787
Virginia.....	183	274	467	427	157	484	257	50	307	927	331	1,236	64	33	97	283	381	614	847	364	711	1,274	689	1,969
Washington.....	168	90	238	516	132	698	485	136	485	1,169	242	1,411	1	1	1	304	62	566	804	63	367	1,473	305	1,778
West Virginia.....	208	115	323	523	202	725	411	136	547	1,278	317	1,685	1	1	1	366	424	790	866	424	790	1,044	741	2,385
Wisconsin.....	252	14	296	216	10	226	95	10	105	608	24	627	1	10	1	179	24	209	180	24	204	783	48	831
Wyoming.....	152	152	152	153	153	153	9	9	9	9	305	314	10	10	10	10	10	10	10	10	10	9	315	524
Subtotal continental United States.....	12,536	10,717	23,253	19,740	9,906	29,646	9,960	4,907	14,867	47,143	20,623	67,766	3,729	1,742	5,471	13,226	13,873	27,099	16,955	15,615	32,570	64,093	36,238	100,336
Hawaii.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Puerto Rico.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Grand total.....	12,536	10,717	23,253	19,889	9,993	29,862	10,076	4,907	14,963	47,408	20,710	68,118	3,735	1,765	5,500	13,278	13,908	27,186	17,013	15,673	32,686	64,421	36,383	100,804

! Individual entries may vary slightly from original reported data due to rounding in millions of dollars.

TABLE 2.—Summary of highway construction needs, 1955-84, by system

[In billions]

System ^{1 2}	Rural	Urban	Total
Interstate system.....	\$12.5	\$10.7	\$23.2
Other Federal-aid primary.....	19.9	10.0	29.9
Federal-aid secondary:			
Under State control.....	10.1		10.1
Under local control.....	4.9		4.9
Total Federal-aid secondary.....	15.0		15.0
Total Federal-aid.....	47.4	20.7	68.1
Other State highways.....	3.7	1.8	5.5
Other roads and streets.....	13.3	13.9	27.2
Total non-Federal-aid.....	17.0	15.7	32.7
Total, all roads and streets.....	64.4	36.4	100.8

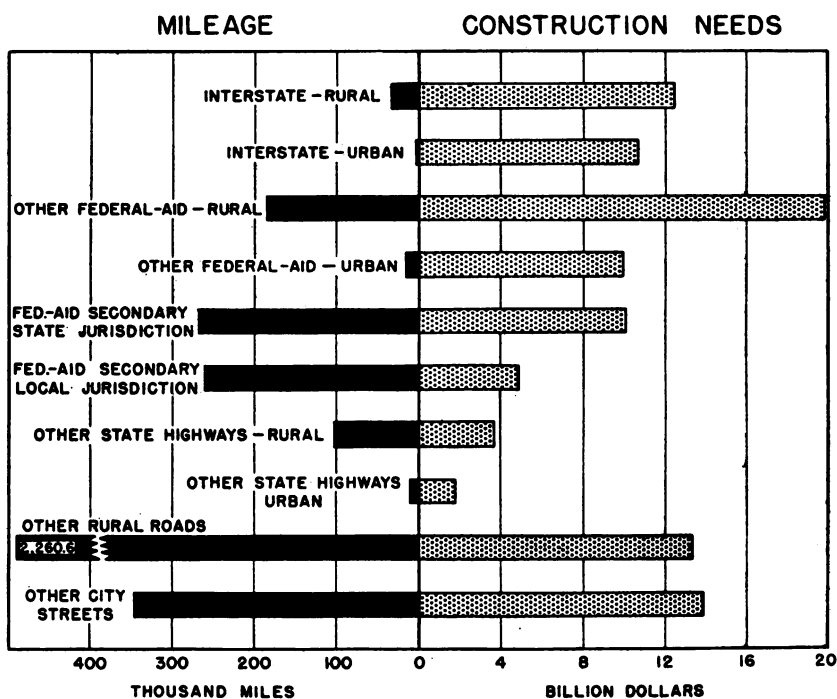
¹ Figures include Hawaii and Puerto Rico. For the continental United States, the total is \$100.3 billion² Costs include that of right-of-way.

Figure 1.—Estimated 1965 mileage and 10-year construction needs, 1955-84, by system.

Unless otherwise separately identified, the various estimates presented here include those of Hawaii and Puerto Rico. A general discussion of the estimates for each road system follows.

Interstate system

Existing routes which approximate the location of the interstate system amount to about 37,700 miles. Of this total, 33,300 miles are

rural and 4,400 are in urban areas. About 15 percent of the mileage as it now exists is already adequate according to the standards established in this study.

These estimates include no allowances for any increase, by the end of 1964, of total mileage in the system. There will, however, be an increase of about 50 percent in traveled lanes. For a substantial portion of the system, nearly 7,000 miles, a 2-lane road will be adequate. The bulk of the proposed improvements, more than 28,000 miles, will be in the 4-lane divided highway category. About 2,300 miles will be 6 or more lanes wide. This latter mileage will, of course, be principally in and approaching the heavier populated areas. Figure 2 shows the approximate location and estimated status of improvement as to lane width, in 1965, of the rural portions of the interstate system.

Construction costs (including structures and right-of-way) on the interstate system range in average from \$200,000 a mile for 2-lane roads in rural areas to \$10 million a mile for multilane sections (over 6 lanes) in urban areas. There are, of course, wide variations from these averages among the States and for individual road sections. In terms of mileage to be constructed, the 4-lane road predominates. Costs of this 4-lane mileage average \$450,000 per mile, rural and \$1,600,000 per mile, urban.

Needed work on the interstate system during the 10-year period 1955-64, according to the State estimates, totals \$23.2 billion, of which \$12.5 billion is in rural and \$10.7 billion in urban areas.

This estimate provides for the development of the interstate system in its present designated extent of 37,700 miles. It does not take into account extensions which will undoubtedly be made within the legislative limitation of 40,000 miles—extensions which will in all probability be almost entirely within and adjacent to the larger urban areas. Estimates of the needs for improvement of these extensions must necessarily await their designation. To a certain extent, the needs are contained in the estimates reported for other road systems.

Other Federal-aid systems

About 75 percent of the presently designated Federal-aid primary system (excluding interstate system mileage) will need some kind of improvement during the 10-year period 1955-64. The comparable value for the Federal-aid secondary system is about 68 percent.

At the end of the 10-year period there will be about 201,000 miles of primary system mileage in service, 185,000 miles rural and 16,000 miles urban. The total of 201,000 miles represents an increase over the 193,000 miles in service in 1953, brought about by the inclusion of extensions anticipated by the States.

The Federal-aid secondary system is also expected to grow. On this system, however, the anticipated increase is somewhat larger in proportion, amounting to a 15-percent increase by 1964 over the miles in service in 1953. (On the basis of past rates, an increase of 20 to 25 percent is indicated.) The mileage in service at the end of the 10-year period on this system has been estimated by the States to be about 530,000 miles and is about evenly divided between roads under State control and those under local control.

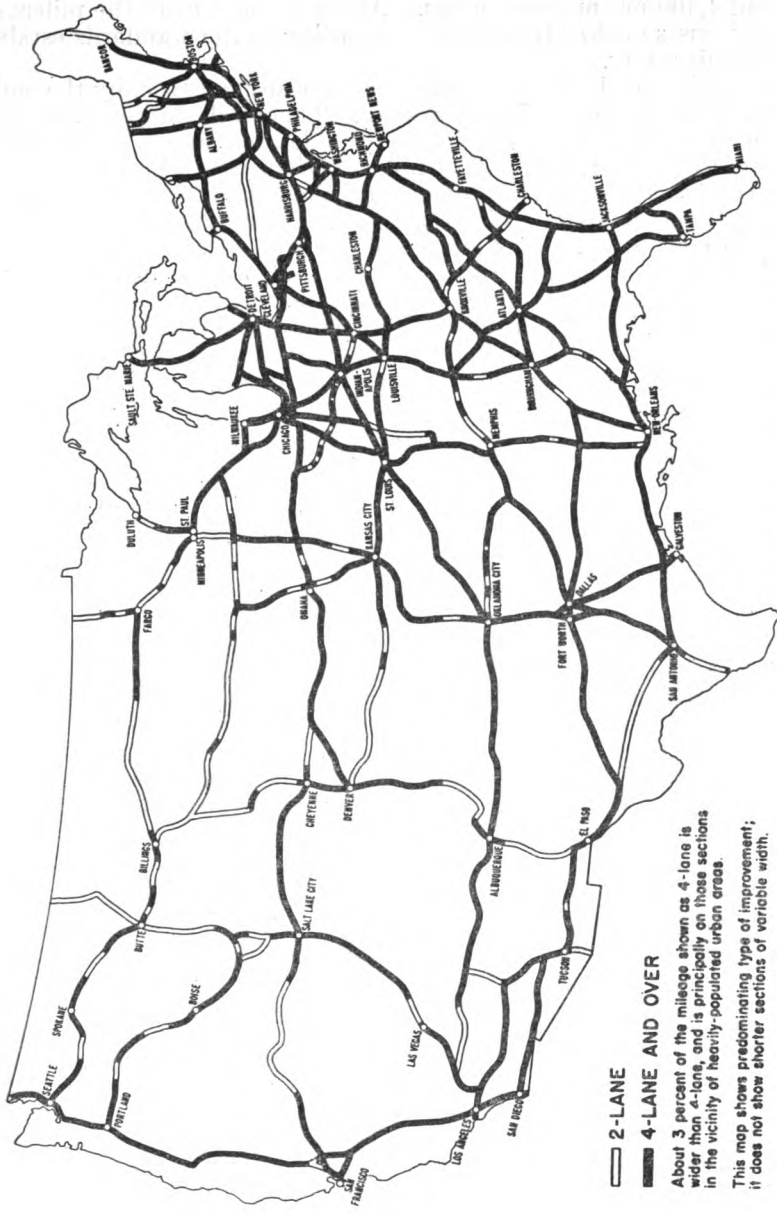


Figure 2.—Estimated status of improvement of Interstate Highways as to lane width, in 1965.

Needed improvements on deficient mileage of the Federal-aid primary system average \$140,000 per mile on rural sections and \$800,000 per mile on urban sections. On the Federal-aid secondary system the average cost is about \$40,000 per mile. There are, of course, considerable variations in these average costs among and within the various States.

The kind of work also varies widely. From a fourth to a third of the mileage in need of improvement on the various systems requires only relatively minor work such as resurfacing or widening. Costs of such work are from a third to a half of the previously cited averages for all work.

At the other extreme are those needed improvements involving construction of a complete new road to replace an old one. The amount of such needed work varies on each system. For example, only one-tenth of the deficient mileage on the secondary system involves the construction of a complete new road on new location, whereas over a third of the needed improvements on the urban portions of the primary system is in this category. Costs of such new construction are about double the previously cited averages for all work. Between these extremes falls the remaining mileage of needed improvements, generally involving substantial reconstruction work along existing alignments.

The estimated work needed on the Federal-aid primary system (excluding the interstate system) during the 10-year period 1955-64 totals \$29.9 billion, of which \$19.9 billion is in rural and \$10 billion in urban areas.

The estimate of needs on the Federal-aid secondary system in the 10-year period totals \$15 billion, of which \$10.1 billion is for roads under State control and \$4.9 billion for roads under local control.

Other State highways

There are now in service 86,000 miles of non-Federal-aid roads and streets under the jurisdiction of State highway agencies—76,000 miles are rural and 10,000 miles are urban. The States anticipate substantial additions to this mileage. By the end of the 10-year period, it 1964, they estimate that 114,000 miles will be in service, 102,000 rural and 12,000 urban.

It was estimated that 59 percent of the existing rural mileage and 47 percent of the existing urban mileage will require improvement within the 10-year period. The cost of needed improvements averages \$51,000 per mile for rural mileage and \$260,000 per mile for urban mileage. There are wide variations in these averages, however, between and within States and by type of work. The total needed work on this mileage during the 10-year period 1955-64, according to State estimates, amounts to \$5.5 billion, of which \$3.7 billion is in rural and \$1.8 billion in urban areas.

Other rural roads and city streets

Over three-fourths of the national total road and street mileage is in the category of local service roads and streets. With a few relatively minor exceptions, this mileage is under the administrative jurisdiction of local units of government (below the State level). In existence at present are nearly 2,300,000 miles of rural roads and about 320,000 miles of urban streets. In 1964, at the end of the 10-year

period, the States anticipate a decrease of about 28,000 miles in rural mileage and an increase of about 28,000 miles in the urban category. These changes are not particularly significant, in relation to the total mileages.

About 54 percent of the existing rural mileage and 48 percent of the existing urban mileage will require improvement within the 10-year period. Costs of needed improvements average about \$11,000 a mile for rural roads and \$77,000 a mile for urban streets.

It is not contemplated that every mile of local roads and streets will be surfaced in the 10-year period. Although the time and means available for preparation of the estimates precluded the development of exact detail, it is known that about 400,000 miles of roads exist only as passable trails. These roads of low essentiality warrant little or no improvement for the limited service they render.

The estimate of needed work on local roads and streets during the 10-year period 1955-64 totals \$27.2 billion, of which \$13.3 billion is for rural roads and \$13.9 billion for city streets.

Itemization of costs

An itemization of the estimates of costs for the 10-year period 1955-64 for right-of-way, grading, surfacing, and structures is shown in table 3. Also shown are the numbers of new and replacement structures needed.

To provide maximum service on the interstate system in terms of capacity, speed, and safety, it is obvious that there should be strict adherence to those standards of design which have proved effective in accomplishing these objectives. The total cost is impressive. The magnitude and proportion of right-of-way and structure costs are particularly large—almost 50 percent more in percentage relation to the total than for any of the other systems.

Such expenditures are required to obtain control of access, long sight distances, easy grades and curves, grade separations and traffic interchanges, frontage roads, and the like. Provision of these features, characteristic of the interstate system, makes improvement of these routes cost as much as one-third more than other Federal-aid primary roads in rural areas, and even more in urban areas. For this added cost, the interstate system roads will have longer service lives and will be capable of carrying twice as much traffic as other roads not incorporating these features, and will carry it more efficiently.

Looming in importance both on a cost basis and a percentage basis is the magnitude of the right-of-way problem in urban areas. The total urban right-of-way costs for the 10-year period are estimated at \$8.2 billion, 23 percent of all urban costs and 8 percent of the entire \$101 billion estimate. The problems and costs involved in acquiring right-of-way have been among the principal deterrents in urban construction programs. The longer acquisition is deferred, the greater will be the difficulties in obtaining satisfactory rights-of-way.

As might be expected, the costs of both right-of-way and structures, in amount and in percentage of system cost, are greatest for the urban portion of the interstate system. The average cost per mile of right-of-way alone in urban areas is more than double the total cost per mile in rural areas, on the interstate system.

TABLE 3.—Itemization of highway construction needs, 1955-64, by system

System ¹	Cost (in billions)					Number of structures	Percentage of system cost				
	Right-of-way	Grading	Surfacing	Structures	Total		Right-of-way	Grading	Surfacing	Structures	Total
Interstate system:						Thou-					
Rural.....	\$1.4	\$3.8	\$4.1	\$3.2	\$12.5	sands	11	30	33	26	100
Urban.....	3.3	1.9	1.4	4.1	10.7	6.5	31	18	13	38	100
Total.....	4.7	5.7	5.5	7.3	23.2	25.2	20	25	24	31	100
Other Federal-aid primary:											
Rural.....	1.9	6.5	8.0	3.5	19.9	37.0	9	33	40	18	100
Urban.....	2.6	2.3	2.5	2.6	10.0	6.4	26	23	25	26	100
Total.....	4.5	8.8	10.5	6.1	29.9	43.4	15	30	35	20	100
Federal-aid secondary:											
Under State control.....	.9	3.6	4.1	1.5	10.1	38.2	9	36	40	15	100
Under local control.....	.4	1.6	2.0	.9	4.9	35.0	8	33	41	18	100
Total.....	1.3	5.2	6.1	2.4	15.0	73.2	9	34	41	16	100
Other State highways:											
Rural.....	.3	1.4	1.4	.6	3.7	18.1	8	38	38	16	100
Urban.....	.4	.5	.5	.4	1.8	1.7	22	28	28	22	100
Total.....	.7	1.9	1.9	1.0	5.5	19.8	12	35	35	18	100
Other roads and streets:											
Rural roads.....	.6	4.8	5.4	2.5	13.3	130.1	4	36	41	19	100
City streets.....	1.9	3.5	6.2	2.3	13.9	12.9	14	25	45	16	100
Total.....	2.5	8.3	11.6	4.8	27.2	143.0	9	30	43	18	100
SUMMARY											
Federal-aid:											
Rural.....	4.6	15.5	18.2	9.1	47.4	128.9	10	33	38	19	100
Urban.....	5.9	4.2	3.9	6.7	20.7	12.9	29	20	19	32	100
Total.....	10.5	19.7	22.1	15.8	68.1	141.8	15	29	33	23	100
Non-Federal-aid:											
Rural.....	.9	6.2	6.8	3.1	17.0	148.2	5	37	40	18	100
Urban.....	2.3	4.0	6.7	2.7	15.7	14.6	15	25	43	17	100
Total.....	3.2	10.2	13.5	5.8	32.7	162.8	10	31	41	18	100
All systems:											
Rural.....	5.5	21.7	25.0	12.2	64.4	277.1	8	34	39	19	100
Urban.....	8.2	8.2	10.6	9.4	36.4	27.5	23	23	29	25	100
Total.....	13.7	29.9	35.6	21.6	100.8	304.6	14	30	35	21	100

¹ Figures include Hawaii and Puerto Rico. For the continental United States, the total is \$100.3 billion.

CONSTRUCTION NEEDS AFTER 1964

There is no foreseeable period in the future when there will be no highway needs. Population growth and other factors in the expanding economy of the United States give every indication that highway travel will continue to increase in the years beyond 1964. Admittedly any attempt to gage with exactness the trend of such future travel, and its attendant highway needs, involves certain hazards. But the alternative of ignoring these future needs is even more hazardous. Sound and defensible long-range highway planning must be based on the best current estimates that can be made of future conditions.

Simply to sustain the investment in the highway plant at the stage of development existing at the end of 1964 will require substantial continuing capital outlays in the years after 1964. For example, by the end of 1964 the highway plant then in service will represent an investment (cost new, 1954 prices) of \$140 billion to \$150 billion. On the basis of a 30- to 35-year life of investment, it would require an average construction expenditure of \$4 billion or more annually to offset the depreciation which would be taking place. In addition, as highway facilities wear out and require rebuilding, provision must be made for substantial upgrading to take care of still further traffic growth.

In recognition of these future needs in the years following the initial 10-year period, each State supplied an estimate of such costs for each road system for the 20-year period 1965-84. These costs, as reported by the States, amounted to \$114.4 billion for all road systems combined. The distribution of this total by systems is shown in table 4.

TABLE 4.—*Summary of highway construction needs, 1965-84, by system*

[In billions]

System ^{1 2}	Rural	Urban	Total
Interstate system.....	\$5.1	\$4.6	\$9.7
Other Federal-aid primary.....	25.0	11.0	36.0
Federal-aid secondary:			
Under State control.....	12.7	.....	12.7
Under local control.....	8.1	.....	8.1
Total Federal-aid secondary.....	20.8	.....	20.8
Total Federal-aid.....	50.9	15.6	66.5
Other State highways.....	5.2	1.8	7.0
Other roads and streets.....	21.5	19.4	40.9
Total non-Federal-aid.....	26.7	21.2	47.9
Total, all roads and streets.....	77.6	36.8	114.4

¹ Figures include Hawaii and Puerto Rico. For the continental United States, the total is \$113.9 billion.

² Costs include that of right-of-way.

Significant relations are revealed by comparing the capital outlay amounts during the 20-year period 1965-84 (table 4) with those for the initial 10-year period 1955-64 (table 2). Probably the most important is that for the interstate system. The needs from 1965 to 1984 are less than half the needs for the first 10 years, 1955-64. For other road systems the 1965-84 needs are greater than those of the initial 10-year period. The reason for this, of course, is that the 1955-64 estimates for development of the interstate system provide that by 1964 it shall be adequate for 1974 traffic. This substantially delays the accrual of replacement needs for a considerable period after 1964. The estimates for other road systems are based on the assumption that they will be adequate by 1964 for 1964 traffic, thus requiring continuing construction, reconstruction, and upgrading of wornout sections in substantial amount in 1965 and later years.

RELATION OF HIGHWAY NEEDS TO THE NATIONAL ECONOMY

The goal of 1964 for achievement of adequacy for all types of highways was adopted because the Congress requested an estimate " * * of the cost of completing the several systems * * " and it was assumed that attainment of adequacy at the earliest possible date was intended. In addition, a single date had to be adopted to assure a common statistical basis for use by the various States in their separate estimates. It is not intended to imply that all needs for highway improvement are equally urgent, or that all needs should be met in the next decade at the expense of other urgent national needs.

To meet all highway needs in 10 years, and maintain adequacy thereafter, construction requirements would be as shown in figure 3, which presents the needs for each 5-year period from 1955 to 1984, with indications of the needs of the interstate system, other Federal-aid systems, and the non-Federal-aid systems. The \$215.2 billion total represented includes the \$100.8 billion from table 2 and the \$114.4 billion from table 4.

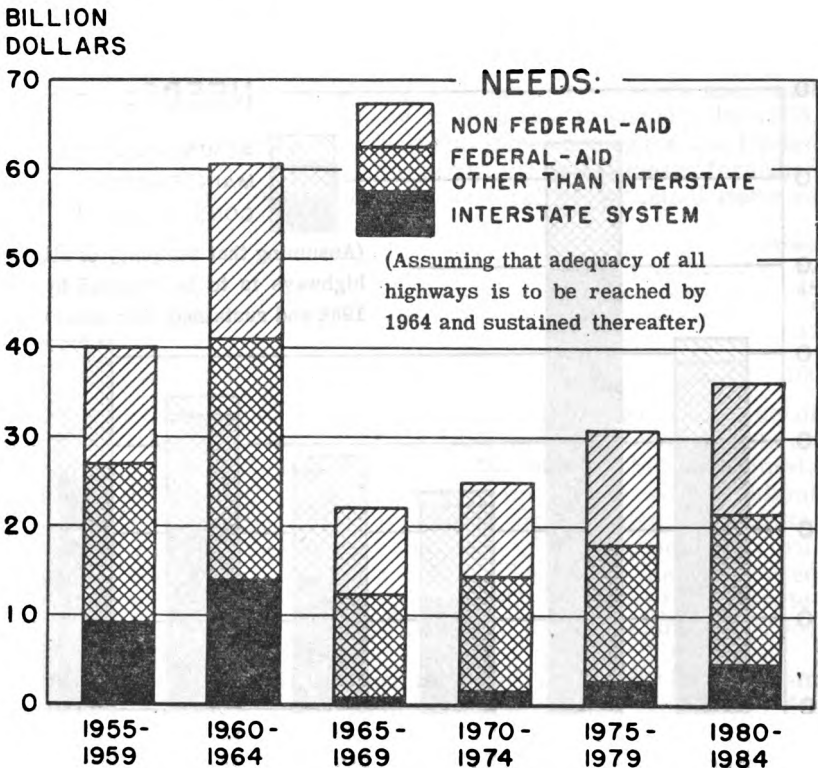


Figure 3.—Construction needs of the Federal-aid and non-Federal-aid systems, 1955-84.

A highway program to meet all needs in 10 years would get under way gradually, and taper off at the end. The needs to be met in 1955 and in 1964 would be less than the \$8 billion and \$12 billion annual averages indicated by the first two bars. Thereafter, the needs for replacement and expansion would start with about \$4.3 billion in 1965 and increase gradually to about \$7.5 billion in 1984. For the intervening years, the annual rates of increase would vary somewhat due to cyclical effects of replacement of the relatively large amount of construction placed in service during the initial 10-year period 1955-64.

Thus an attempt to meet the goal of adequacy of all highways by 1964 would produce a heavy concentration of construction expenditures in the 1955-64 decade and a sharp drop in the immediately following years (see figs. 3 and 4). A more uniform rate of expenditures, however, would appear more consistent with overall economic and fiscal policies. Because of its importance in the national economy and in national defense, the interstate system undoubtedly should be of first priority in any overall highway program of the future. The generally less urgent needs of the other systems could be met more gradually.

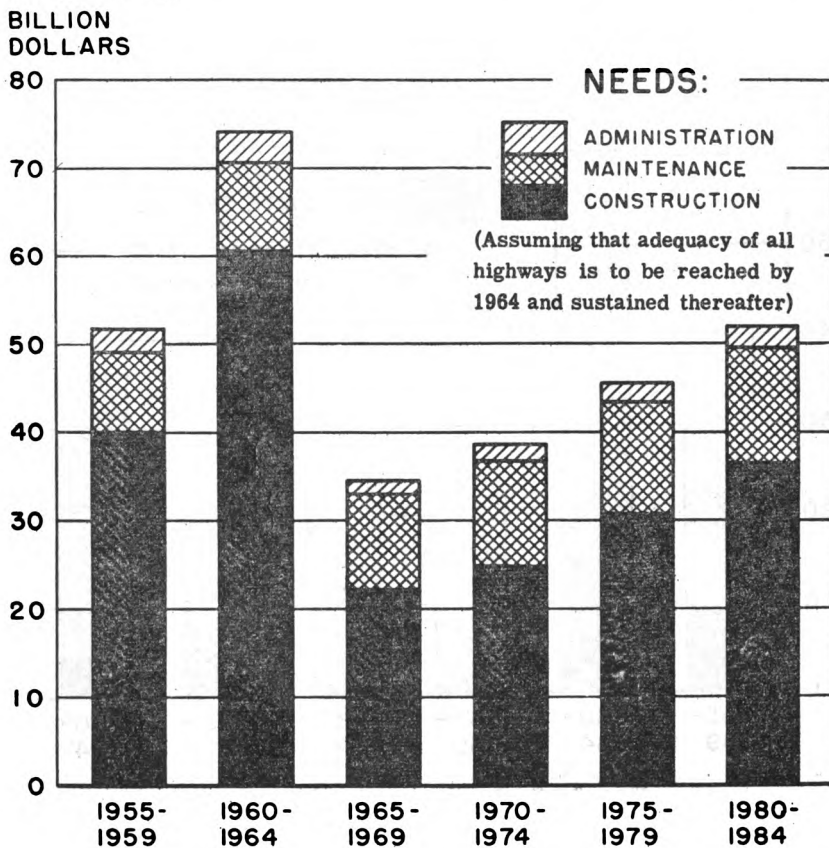


Figure 4.—Total needs of all systems, 1955-84:
Construction, maintenance, and administration.

It is of interest to examine the highway construction expenditures of the past, and those estimated as future needs, in comparison with the gross national product, which is a measure of the Nation's economy.

In the early 1920's, highway construction expenditures averaged 1.2 percent of the gross national product, and gradually increased to a peak of 1.8 percent in 1931. The ratio declined somewhat, to a low of 1.2 percent in 1935, rose again to 1.7 percent in 1938, and thereafter dwindled to a low of 0.2 percent during World War II. In the first postwar years the figure climbed rapidly, reaching 0.8 percent in the 4 years 1949-52, and continued upward to 1.1 percent in 1954.

Fulfillment of all highway needs within a 10-year period would require, during 1955-64, construction expenditures averaging 2.4 percent of the anticipated gross national product, with a range from 1.2 percent in 1955 up to 3.0 percent in 1960 and 1961 and back to 2.1 percent in 1964.

If the needs were so fulfilled, construction needs for replacement and expansion thereafter would continue at a fairly constant proportion of the gross national product, averaging about 0.8 percent a year.

MAINTENANCE NEEDS

Maintenance needs are additional to construction needs and must be considered in the total costs of a highway program. In 1955, maintenance expenditures for all road and street mileage in the United States will total about \$1.75 billion, according to estimates furnished by each State. The distribution of this total by principal items of expense is as follows:

	<i>Percent</i>
Roadside.....	32
Surface.....	48
Structures.....	8
Snow and ice control.....	12
Total.....	100

Maintenance costs per mile range from a nationwide average of \$250 per mile for local roads to \$2,900 per mile for urban streets on the interstate system as it now exists. By 1965 the States estimate that the needed annual expenditure for maintenance will rise about 22 percent above the 1955 total, in order to provide adequate maintenance on the roads and streets at the stage of development that will exist at the end of the 10-year period. The States also estimated maintenance needs for the 20-year period 1965-84. The total maintenance needs in 1984 will average about 57 percent above the 1954 level for all systems, combined.

The total estimated maintenance needs are shown for each system in table 5, broken down into amounts for the first 10 years, 1955-64, and for the next 20 years, 1965-84.

TABLE 5.—*Maintenance needs, 1955-64 and 1965-84, by system*

[In billions]

System ¹	First 10 years, 1955-64			Next 20 years, 1965-84		
	Rural	Urban	Total	Rural	Urban	Total
Interstate system ²	\$0.6	\$0.1	\$0.7	\$1.6	\$0.4	\$2.0
Other Federal-aid primary.....	2.6	.4	3.0	6.5	1.1	7.6
Federal-aid secondary:						
Under State control.....	2.2	-----	2.2	5.7	-----	5.7
Under local control.....	1.7	-----	1.7	4.1	-----	4.1
Total Federal-aid secondary.....	3.9	-----	3.9	9.8	-----	9.8
Total Federal-aid.....	7.1	.5	7.6	17.9	1.5	19.4
Other State highways.....	.7	.2	.9	1.9	.5	2.4
Other roads and streets.....	6.4	4.5	10.9	15.7	11.3	27.0
Total non-Federal-aid.....	7.1	4.7	11.8	17.6	11.8	29.4
Total, all roads and streets.....	14.2	5.2	19.4	35.5	13.3	48.8

¹ Figures include Hawaii and Puerto Rico. For the continental United States, the 1955-64 total is \$19.3 billion and the 1965-84 total is \$48.6 billion.

² Due to rounding of figures, the interstate system needs are somewhat understated for 1955-64. The estimates are \$618 million for rural and \$143 million for urban.

With the exception of the interstate system, the maintenance cost estimates appear reasonable. Lack of sufficient experience on the part of many States in maintaining the types of highway built to interstate system standards may have resulted in some underestimating of the costs on that system. In States, for example, where an appreciable mileage of divided highways now exists (100 miles or more), the estimated costs of maintaining mileage built to interstate system standards were higher than for other States which have had only limited experience in maintaining such facilities. Using the data from the more experienced States as a guide, it is probable that, on a nationwide basis, the estimates of maintenance needs for the interstate system as it will exist in 1965 and future years are understated by about 20 percent. Since it was considered preferable to retain the estimates reported by the States to the maximum possible extent, no revisions have been made in the entries in table 5 to reflect this possible increase.

ADMINISTRATIVE COSTS

In addition to estimating future construction and maintenance costs for the several road systems, each State also prepared an estimate of those administrative costs which were not included elsewhere in the estimates. Highway patrol and other traffic police costs were not included.

Administrative costs were estimated to be slightly less than 5 percent of the combined total cost of construction and maintenance for all systems combined. Minor variations exist with respect to individual systems. The percentage was slightly lower than the average on local roads and streets and slightly above the average on the interstate system and other Federal-aid primary highways. Considerably wider variations existed between individual States. Such differences can be expected, however, because of varying practices among the States in accounting for administrative costs. Some elect

to retain such costs in a separate account whereas others include a substantial proportion in the construction and maintenance accounts. In either event, the administrative costs, as herein summarized, represent the net amount of such costs not elsewhere included.

Table 6 shows, by system, the amounts of the administrative costs, as determined from the States' estimates, for the initial 10-year period 1955-64, and for the following 20-year period 1965-84.

TABLE 6.—Administrative needs, 1955-64 and 1965-84, by system

[In billions]

System ¹	1st 10 years, 1955-64			Next 20 years 1965-84		
	Rural	Urban	Total	Rural	Urban	Total
Interstate system.....	\$0.7	\$0.6	\$1.3	\$0.4	\$0.3	\$0.7
Other Federal-aid primary.....	1.2	.5	1.7	1.6	.6	2.2
Federal-aid secondary:						
Under State control.....	.6	-----	.6	.9	-----	.9
Under local control.....	.3	-----	.3	.6	-----	.6
Total Federal-aid secondary.....	.9	-----	.9	1.5	-----	1.5
Total Federal-aid.....	2.8	1.1	3.9	3.5	.9	4.4
Other State highways.....	.2	.1	.3	.3	.1	.4
Other roads and streets.....	.9	.8	1.7	1.6	1.4	3.0
Total non-Federal-aid.....	1.1	.9	2.0	1.9	1.5	3.4
Total, all roads and streets.....	3.9	2.0	5.9	5.4	2.4	7.8

¹ Figures include Hawaii and Puerto Rico. For the continental United States the above rounded totals are unchanged.

TOTAL NEEDS

Figure 4 shows the total highway needs for each 5-year period, starting from 1955, to the end of 1984. Portions of each bar representing construction are the same as the total heights of bars in figure 3. The amounts for maintenance and administration are shown in addition. The first 2 bars represent the 10-year needs total of \$126.1 billion, consisting of \$100.8 billion for construction, \$19.4 billion for maintenance, and \$5.9 billion for administration. The remaining 4 bars represent additional needs for these 3 purposes from 1965 to 1984: The \$171.0 billion total for the 20-year period consists of \$114.4 billion for construction, \$48.8 billion for maintenance, and \$7.8 billion for administration.

The total estimated needs for the entire 30-year period from 1955 to 1984, then, amount to \$297.1 billion, of which 72 percent is for construction, 23 percent for maintenance, and 5 percent for administration.

Over the 30-year period the total needs average out to \$9.9 billion a year. By way of comparison, the estimated total expenditure (exclusive of debt service) for all roads and streets in 1954 was \$6.1 billion, of which 64 percent was for construction.

FINANCING THE HIGHWAY NEEDS

The cost of bringing the Nation's roads and streets to adequacy in 10 years has been estimated at \$100.8 billion. If the present rates of taxation of motor fuel are continued and the present structures of

registration fees and other special user taxes are continued, if allowance is made for the estimated increases in vehicle registration and use of motor fuel during the next 10-year period, and if the current rates of expenditures for maintenance and administration are continued, it is estimated that \$47 billion will become available for highway construction. Thus a deficit of \$54 billion must be overcome if the estimated 10-year needs are to be met.

Should the interstate system be completed in that period, on the basis of these cost estimates, it would be in a condition adequate for 1974 traffic, and need for expenditures on that system would drop sharply. On the other systems, however, improvements in the 10-year period would be confined to sections that otherwise would be inadequate for 1964 traffic. Thus, as shown in figures 3 and 4, expenditures for construction on the other systems, and maintenance and administration costs on all systems, would continue to be substantial and would steadily increase.

Decision as to a suitable financing program must take into consideration the proportion of the total cost that can and should be borne by each of the various jurisdictions involved—Federal, State, and local. Decision must also be influenced by the amount of expenditure that may properly be devoted to highway construction during any period in relation to expenditures for other public works and in relation to the entire economy of the country. And decision must also take into consideration the means by which funds can be made available—such means as general taxation, highway-user taxation, and borrowing through general-obligation or toll-revenue bonds. All these means are used, singly or in combination, in financing the various segments of our highway systems.

Recognizing the need for a broad review of the whole problem of highway needs and finance, the President, since the passage of the 1954 Federal-Aid Highway Act, appointed an Advisory Committee on a National Highway Program to recommend a means for modernizing the Nation's road and street network. The President also requested the governors to review the same problem and advise him as to the manner in which the States could most effectively cooperate with the Federal Government in its solution.

A special committee representing the governors was set up, and its recommendations were transmitted to the President in the report of the Executive Committee of the Governors' Conference, in December 1954. This report recommended that—

for purposes of financing, the various highway systems should be divided into three categories—the interstate system, including essential urban access roads, other Federal-aid systems, and the State and local systems.

It further recommended that (1) the Federal Government should assume primary responsibility, with State participation, for financing the interstate system, and (2) so long as the Federal Government levies excise taxes on motor fuels, lubricants, and motor vehicles, it should continue to make allocations to the States for highway construction on the other Federal-aid systems.

This report is particularly significant in that it did not recommend that the Federal Government relinquish excise taxes on motor fuels, lubricants, and motor vehicles. The governors' representatives also recommended that the cost of meeting the total highway construction

needs should be divided between the Federal Government and the State and local governments in the ratio of 30 percent Federal and 70 percent State and local.

State and local governments have responsibility for the entire cost of constructing those road systems for which Federal aid is not available and for matching in statutory ratio the Federal funds provided for participation in the cost of construction on the Federal-aid systems. Of approximately 3,400,000 miles of roads and streets about 230,000 miles are included in the Federal-aid primary system and 460,000 in the Federal-aid secondary system. It is in the improvement of these systems, totaling about 700,000 miles, that the States and local agencies participate with the Federal Government in varying degree. Thus nearly 2,700,000 miles are the sole responsibility of the State and local jurisdictions.

Provision of funds required by State and local agencies to meet their historic responsibilities for highways presents serious problems that have been met in various ways. Many State and local governments are actively working to provide increased funds for highway purposes. The means proposed to supply the added funds vary widely with local conditions and the policies of the various jurisdictions.

The problem of financing the Federal share of meeting the total highway needs was considered by the President's Advisory Committee on a national highway program. In its report of January 1955, the Committee sets forth its conclusions and recommendations covering Federal participation in financing needed improvements on the interstate and other Federal-aid systems.

The plan of the President's Advisory Committee is in accord with the principles expressed in the report by the executive committee of the Governors' Conference. The plan was transmitted by the President to the Congress for use in its deliberations on the highway program. It contains detailed recommendations for financing the portion of the total highway needs recognized by the Advisory Committee and also by representatives of the governors as the responsibility of the Federal Government.

In developing its financing plan the Advisory Committee had the benefit of information on the extent and cost of improvements required on the various highway systems, supplied to the Bureau of Public Roads by the State highway departments to enable the Secretary of Commerce to respond to the provisions of section 13 of the Federal-Aid Highway Act of 1954. The Advisory Committee's recommendations, therefore, are regarded as meeting the provisions of that section of the act with respect to a study of highway financing, since they cover the Federal responsibilities insofar as the Committee believed they can be foreseen at this time.

In essence, the President's Advisory Committee recommends a total construction expenditure by the Federal Government of \$31.225 billion over the next 10 years. Of this total, \$25.00 billion is for the interstate system including essential urban arterial connections, \$3.15 billion for the remainder of the Federal-aid primary system, \$2.10 billion for the Federal-aid secondary system, \$0.75 billion for the Federal-aid urban system, and \$0.225 billion for forest highways. Financial participation by State and local governments would amount to \$2.00 billion on the interstate system including essential urban

arterial connections. For the other Federal-aid systems, statutory matching requirements would remain unchanged and would amount to slightly less than the Federal contributions of \$6.225 billion. To meet the total estimated cost of \$45.005 billion needed to bring these other Federal-aid systems (and the forest highway system) up to adequacy in the 10-year period, however, would require a total expenditure by the State and local governments of \$38.78 billion in addition to Federal funds.

The program recommended by the Advisory Committee calls for substantially increased Federal expenditures. Adoption of this program would give definite promise of early completion of the interstate system, so essential to the national defense and the Nation's economy, and continued support to the other Federal-aid systems.

The amount of funds required to bring the road systems to adequacy in a reasonable time, and to sustain them in a state of adequacy, is large. Should the cost be distributed among all vehicles, over the life of the roads, the additional cost per mile of travel would be very small, amounting to about one-quarter of a cent per vehicle-mile. About three-fourths of a cent per vehicle-mile is now being collected in the form of road-user taxes. These amounts may be compared to the cost of owning and operating a vehicle, which for passenger cars is variously estimated at from 8 to 10 cents per mile, and for trucks at correspondingly higher figures. The cost of the highway itself is but a small part of the total cost of motor-vehicle transportation.

