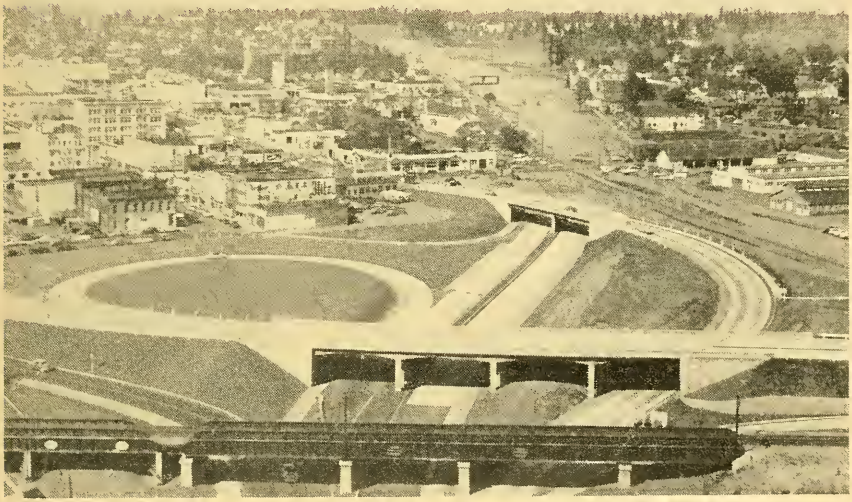
ANNUAL REPORT

Bureau of Public Roads

FISCAL YEAR 1954



The first completed section of the Vancouver Freeway in Vancouver, Washington

DEPARTMENT OF COMMERCE

U. S. DEPARTMENT OF COMMERCE

SINCLAIR WEEKS, Secretary

BUREAU OF PUBLIC ROADS

FRANCIS V. du PONT, Commissioner

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ANNUAL REPORT OF THE BUREAU OF PUBLIC ROADS

Factors Affecting Progress

THE FEDERAL-AID HIGHWAY PROGRAM and highway construction without Federal assistance reached new high levels in the fiscal year 1954.[1] Both the dollar volume and actual physical improvements showed a substantial increase over the preceding year, continuing a trend that has existed each year since the end of the war, with the exception of 1951. There was an increase in funds available for highways, keener competition among contractors for jobs, a decrease in bid prices, and a nationwide demand from highway users for more rapid highway improvement.

Contractors seeking highway work were numerous: The number of bids per job averaged 6.9 as compared with 5.3 in the preceding year. The decline in bid prices, which began in the final quarter of the preceding fiscal year, continued throughout the fiscal year 1954. At the end of the year prices were 8.9 percent below the peak of 1953. This resulted from keener competition, and possibly from the number of jobs of larger size. Costs to contractors for labor, materials, and equipment increased slightly.

The number of motor vehicles, the volume of traffic, and congestion continued the rapid growth that began at the end of the war. Motor vehicles registered increased by 3 million in the calendar year 1953. An increase of 1.8 million in 1954 was expected to bring the total to over 58 million vehicles. Mileage traveled on all roads and streets increased 3.3 percent during the fiscal year.

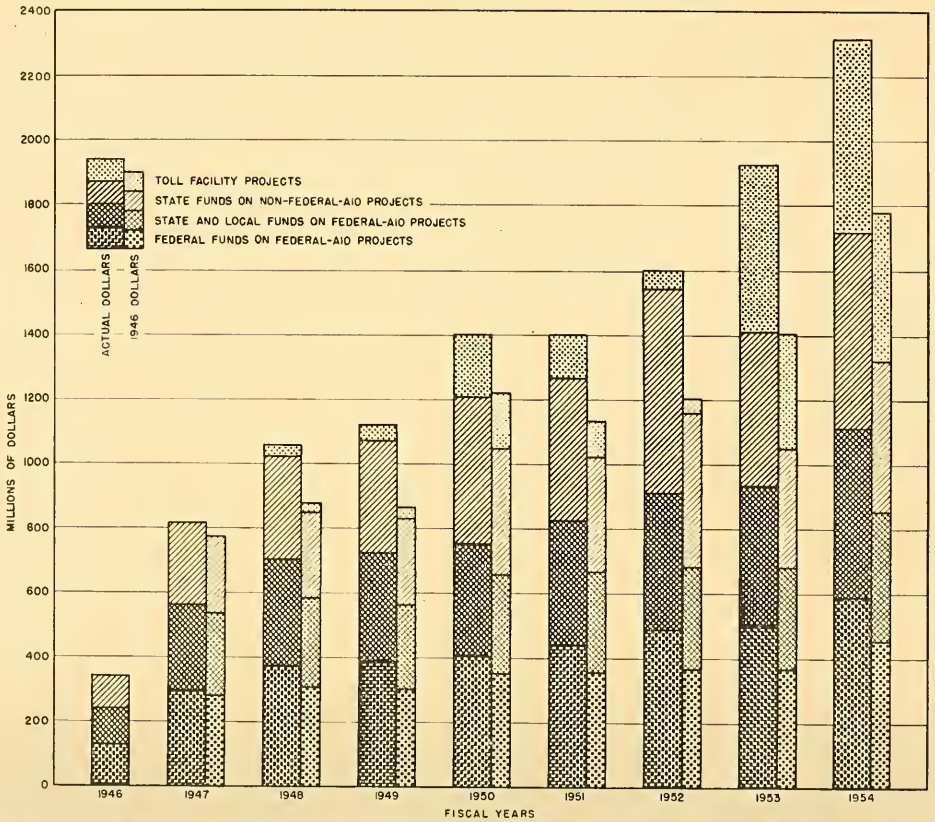
The most significant trend of the year was the increasingly strong demand that steps be taken to make our highway systems adequate within the shortest possible period. Results of the national highway study conducted by the Subcommittee on Roads of the Committee on Public Works of the House of Representatives were presented to the Congress when it convened in January. Testimony of representatives of industry, agriculture, defense agencies, and highway-user groups and of State and city officials all showed that a greatly enlarged highway program was needed. Particular emphasis was laid on the need for improvement of main arteries interconnecting cities and for express highways in cities. Few proposals of public policy have aroused such strong support from so many sources as was presented for an enlarged highway program.

As a result of this presentation, and continued support at hearings on specific legislation, the Congress authorized a much enlarged Federal-aid program for the fiscal years 1956 and 1957 which was approved by the President on May 6, 1954. The general provisions of this legislation are summarized on page 3.

The legislation met with widespread approval, but neither Congress nor highway officials regarded it as a full solution of highway problems. One of its provisions required that the Secretary of Commerce submit to Congress a comprehensive report on highway problems not later than February 1, 1955.

There followed a series of events that give promise of more complete consideration of highway problems than ever before, and of more adequate provision for highways by the States and the Federal Government. On July 12, 1954, Vice

[1] The fiscal year extended from July 1, 1953, to June 30, 1954.



Highway construction contracts awarded by State highway departments and toll authorities.

President Nixon delivered an address, from notes prepared by the President, before the Governors Conference at Bolton Landing, N. Y. He urged that steps be taken toward a more adequate highway program.

The Governors Conference, stirred to action by the urgency of the President's statement, appointed a committee to study the problem and make recommendations to the President.

In August the President created an advisory committee, headed by General Lucius D. Clay (retired), to help him solve State-Federal problems relating to highways. He also appointed a Federal Interagency Committee to study highway policy.

The American Association of State Highway Officials and other national groups indicated an active interest in giving effect to the President's recommendation that there be "* * * a grand plan for a properly articulated system that solves the problems of speedy, safe, transcontinental travel—intercity communication—access highways—and farm-to-market movement—metropolitan area congestion—bottlenecks—and parking."

New Highway Legislation

The Federal-aid Highway Act of 1954, approved May 6, 1954, authorized the largest Federal-State cooperative highway program in history. For improvement of the Federal-aid systems there was authorized $875 million for each of the fiscal years 1956 and 1957, an increase of 52 percent over the highest amount in any previous year. The funds for 1956 were apportioned and made available to the States on July 1, 1954, 6 months ahead of the usual time of apportionment, in order to accelerate highway improvement. A comparison of funds authorized by the act of 1954 with those of the act of 1952 is shown in the table below.

Funds authorized by the Federal-aid Highway Acts of 1952 and 1954

Authorization	Act of 1952: For each of fiscal years 1954 and 1955 [1]	Act of 1954: For each of fiscal years 1956 and 1957
Federal-aid systems:		
Primary	$247,500,000	$315,000,000
Secondary	165,000,000	210,000,000
Urban	137,500,000	175,000,000
Interstate system	25,000,000	175,000,000
Total Federal-aid	575,000,000	875,000,000
Forest highways	22,500,000	22,500,000
Forest roads and trails	22,500,000	24,000,000
Park roads and trails	10,000,000	12,500,000
Parkways	10,000,000	11,000,000
Indian roads	10,000,000	10,000,000
Public land roads	2,500,000	1,000,000
Subtotal	77,500,000	81,000,000
Latin American work	[2] 10,000,000	[3] 10,000,000
Grand total	662,500,000	966,000,000

[1] The act of 1952 also authorized $50 million for defense access roads, not assignable to a specific fiscal year.
[2] Authorized for each of the fiscal years 1953 and 1954.
[3] Authorized for each of the fiscal years 1955 and 1956. In addition, $8 million was authorized for each of the fiscal years 1957–59, inclusive.

The act contains several new features designed to improve Federal-aid operations. With respect to funds for interstate highways, the new act places added weight on the population factor in the apportionment. Apportionments are to be made as follows: One-half in the ratio which the population of each State

bears to the total population of all States, and one-half in the manner now provided by law for apportionment of funds for the Federal-aid primary system. The Federal share payable on any project on the Interstate System from the interstate funds provided by the 1954 act is increased to 60 percent.

The act permits the transfer of up to 10 percent of primary, urban, and secondary funds from one category to another, thus providing greater flexibility in their use. No one fund may be increased through such transfers by more than 10 percent.

Another new provision relating to secondary roads will result in simplification and economies of administration, and place greater responsibility in the States. This provision authorizes the Secretary of Commerce, upon request of any State, to discharge certain of his responsibilities relative to secondary projects by accepting the State's certification that the work has been done in accordance with standards and procedures previously approved.

The act provides broadened authority for research programs relating to such matters as design, construction, safety, financing, and use of highways. It directs that various types of highway research studies be made.

The Secretary of Commerce is directed to prepare and submit to Congress by December 31, 1954, a suggested draft of a bill for a Federal Highway Act, which will include such provisions of existing law and such changes as he may deem advisable. He is also required to report on problems posed by necessary relocation and reconstruction of public utility services resulting from highway improvements. A third report required by the act is a comprehensive study of all phases of highway financing (see p. 31).

Improvements in Economy and Efficiency of Bureau Operation

During the year a number of changes were made in the internal functioning of the Bureau, to improve the efficiency and economy of its operations. The organization is an old one and a number of top positions were held by men past the retirement age of 70 who had continued in service under temporary appointment. This policy adversely affected the promotion of younger men and was discontinued.

An important change effected in the headquarters organization was consolidation of the Division of Programs and Design with the Division of Construction and Maintenance in a new Division of Engineering.

The research program of the Bureau was reviewed by a committee composed of outstanding representatives of various activities in the highway field. Suggestions made by the committee were adopted. Near the end of the year a new system of control over research projects was installed, its purpose being to select for prosecution those projects for which there is the greatest need, to limit the program to a size suitable for accomplishment with available funds and personnel, and to keep a close check on progress of projects with a view to abandonment of those that do not promise useful results within a reasonable period of time.

Issuance of a series of maps showing highway and other transportation routes was discontinued since the information was available from other sources.

Faced with the largest Federal-aid highway program in history, the Bureau revised its procedures to handle the work without any material increase in personnel. A review was made of reporting practices, forms used, and approvals required. Some were eliminated and others consolidated, with a resulting reduction in paper work.

Much greater authority was centered in the district offices of the Bureau, in each State. Federal-aid system revisions and programs of projects proposed by the States for improvement with Federal aid must be sent to Washington for approval. The district engineer of the Bureau may now approve most steps

taken thereafter, without waiting to hear from the division or headquarters offices. This change greatly reduced the time necessary to get construction under way. The States continued to consult specialists of the Bureau in the division and headquarters offices on the design of large and complex projects such as expressways and major bridges, but they did this, in general, because they desired consultation rather than to meet a requirement. In some instances the advice of the Bureau was sought on plans for non-Federal-aid projects.

Subsequent pages of this report indicate the considerable growth in size of the Federal-aid program during the year. However, economies effected permitted handling the additional workload with a reduction in administrative expenditures of $438,000 below the figure for the previous year.

The number of permanent employees of the Bureau was reduced by 128 during the fiscal year.

The Federal-Aid Program

Federal-aid funds of $575 million authorized for the fiscal year and remaining balances of prior authorizations, together with State and local matching funds, financed the program carried forward during the year. All classes of Federal and Federal-aid projects completed during the year had a combined total length of 20,989 miles. The decrease of 2,637 miles or 11 percent from the all-time record established the previous year resulted from the inclusion of a greater dollar volume of work in urban areas where costs per mile are high. The total cost of projects completed during the year increased by $23 million, or 2 percent, over the previous year.

The 20,989 miles of highways completed during the year included 4,488 miles of highways and 995 bridges on the Federal-aid primary highway system outside of cities (principal intercity routes), 767 miles of highways and 453 bridges on urban portions of the Federal-aid primary highway system, 14,995 miles of highways and 1,631 bridges on secondary or farm-to-market roads, and 739 miles of highways in National forests, parks, parkways, and flood relief projects. In furtherance of the long-term program of eliminating hazards at railway-highway grade crossings, 193 crossings were eliminated, 21 inadequate grade-crossing structures were reconstructed, and 315 crossings were protected by the installation of flashing lights or other safety devices.

Projects for the construction of 23,045 miles were programed during the year, and nearly all States were allotting funds apportioned for the fiscal year 1955 to programed projects. During the year contracts were awarded for improvements to 21,878 miles of highways and streets. Construction put in place during the year amounted to 103 percent of the year's $575 million authorization. At the years' end, construction was under way or scheduled to start soon on 23,719 miles of highways and streets. Details of accomplishments during the year and the status of the program at the end of the year are shown in tables in the appendix.

Classes of Federal-Aid Work

Federal funds for three classes of highways—primary, secondary, and urban—have been included in Federal-aid highway authorizations since World War II. A total of $550 million was authorized for these three classes of highways for each of the fiscal years 1954 and 1955 by the Federal-aid Highway Act of 1952. In addition, this act authorized $25 million each year for improvements to the National System of Interstate Highways.

The Federal-aid Highway Act of 1954 raised the annual authorization rate to $700 million for the fiscal years 1956 and 1957 for primary, secondary, and urban highways, and raised to $175 million the rate for the National System of Interstate Highways.

Federal-aid primary highway system

The Federal-aid primary highway system is made up of the principal highways of the Nation and includes 215,595 miles of rural highway and 18,812 miles of urban highway. Federal funds for the system have been provided continuously since the Federal Highway Act of 1921 made provision for its designation. Primary fund authorizations, which are available for the improvement of both rural and urban portions of the Federal-aid primary highway system, amounted to $247.5 million for each of the fiscal years 1954 and 1955 and $315 million for each of the fiscal years 1956 and 1957.

Federal-aid secondary highway system

Routes in the designated Federal-aid secondary highway system include farm-to-market routes, rural mail routes, and school bus routes. It is 482,972 miles in extent. Beginning with the fiscal year 1938, funds for secondary roads have been included regularly in Federal-aid authorizations. Authorizations of secondary funds amounted to $165 million for each of the fiscal years 1954 and 1955 and $210 million for each of the fiscal years 1956 and 1957.

Federal-aid urban primary system

The Federal-aid urban primary system is 18,812 miles in extent and is a part of the Federal-aid primary highway system. Continuously since the fiscal year 1946, funds have been provided specifically for improvement of the Federal-aid primary highway system in urban areas. Provision of this separate authorization for urban work evidenced congressional concern over the urban traffic problem. Authorizations of urban funds amounted to $137.5 million for each of the fiscal years 1954 and 1955 and $175 million for each of the fiscal years 1956 and 1957. Approximately one-eighth of all primary funds allotted to projects have been utilized for improvements in urban areas.

National System of Interstate Highways

The National System of Interstate Highways is made up of the heaviest traveled main arteries of the Nation. It is an integrated network of routes that connect our country's principal metropolitan areas, cities, and industrial centers, serve the national defense, and connect at suitable border points with routes of continental importance in Canada and Mexico.

The routes are included in and are the most important portions of the Federal-aid primary system. The Interstate System is now 37,600 miles in extent and is limited by law to 40,000 miles. The remaining mileage is reserved primarily for urban sections.

The first Federal funds authorized specifically for the improvement of the National System of Interstate Highways were provided by the Federal-aid Highway Act of 1952, which authorized $25 million for each of the fiscal years 1954 and 1955. These funds were made available on the regular matching basis of 50 percent Federal and 50 percent State funds. The Federal-aid Highway Act of 1954 raised the annual authorization rate to $175 million for each of the fiscal years 1956 and 1957, and revised the matching basis for the 1956 and 1957 interstate funds to 60 percent Federal and 40 percent State funds.

Status of Work at End of Fiscal Year

The active Federal-State cooperative program at the close of the fiscal year (table 2 of appendix) consisted of improvements to 22,820 miles of highways and streets and construction of 4,397 bridges. This work was included in projects for which plans had been approved or construction had been started but not yet completed. The total estimated cost of this work was $1.94 billion, including

$986 million of Federal funds. Included in the active work were the elimination of 331 railway-highway grade crossings, the reconstruction of 50 inadequate grade-separation structures, and the protection of 241 railway-highway grade crossings by the installation of flashing lights or other safety devices.

Work under programs for highway improvements in National forests and parks, public lands, and in the restoration of flood-damaged roads and bridges involved improvements to an additional 899 miles at a total estimated cost of $53 million, including $47 million of Federal funds.

The National System of Interstate Highways

Improvements on the National System of Interstate Highways since its establishment in 1947 have been financed largely with regular Federal-aid primary or urban funds matched by State funds. The States' recognition of the importance of this system is evidenced by the fact that 27 percent of the primary funds and 43 percent of the urban funds since World War II have been applied to improvement of the Interstate System. These funds, together with State matching funds, represent an expenditure of $1,736,221,969. They have been supplemented by $65 million of interstate funds and State matching funds available for the fiscal years 1954 and 1955.

Projects on the Interstate System have been numerous. Sections of four-lane divided highways have been constructed in practically every State and construction of expressways has begun in almost all of the large cities on the system. However, progress has been far below the rate required.

Greater emphasis has been placed on the need for acquiring full control of access on all projects on the Interstate System.

Improvement of Urban Highways

During the fiscal year, as in past years, projects financed with Federal-aid urban funds were substantial in character and expressway type projects continued to absorb about two-thirds of these funds. Some States found it desirable to use some of the funds to eliminate local bottlenecks.

Total Federal-aid urban funds programed during the year amounted to $166,480,691. Plans were approved which will utilize $147,072,955, and projects placed under construction involved $151,304,644. Federal-aid urban highway projects completed during the year totaled 269 miles, involving Federal participation amounting to $129,993,874 of a total expenditure of funds from all sources in the amount of $256,651,068.

A number of cities experienced notable relief of traffic congestion through the completion of significant elements of their arterial street systems. Cities which opened additional sections of expressway during the year included Atlanta, Detroit, Los Angeles, Oakland, Seattle, and the Allentown-Bethlehem area in Pennsylvania.

In the development of highway improvement programs for urban areas, more consideration was given to the overall needs of the municipality. Federal-aid urban systems selected primarily on the basis of service to the greatest number of highway users, as determined by traffic surveys, were being examined for improvement potential. This was especially true of routes on the Interstate System, which often cannot be developed to suitable standards on locations penetrating the heart of the city. Traffic congestion through these focal points sometimes can best be relieved by improvement of belt routes. Special emphasis was laid on control of access. It has been repeatedly demonstrated that the permanent utility of new highways can be assured only through development of controlled-access facilities.

A new policy initiated during the year permitted the States to list as a part of their Federal-aid program, projects for right-of-way acquisition for which Federal funds may be requested in the future. Costs of right-of-way acquired by a public agency after Bureau of Public Roads approval of such programs may be paid, in part, with Federal funds when the projects are later advanced to construction with Federal participation. It is anticipated that this procedure will encourage States and their political subdivisions to acquire critical portions of right-of-way which, because of pending developments, may be unobtainable when needed. For example, this procedure was adopted in connection with the projected North-South Expressway in Louisville, Ky. The city had some money available to apply on the initial purchase of right-of-way but the State was not ready to program the project for construction. Steps were taken to acquire a portion of the right-of-way, which will result in a large saving in cost and assure construction of the expressway.

Improvement of Primary Highways

During the fiscal year, improvements involving Federal-aid primary funds were completed on 4,693 miles of the Federal-aid primary highway system at a total cost of nearly one-half billion dollars. Completed work involved 3,573 miles of bituminous and concrete surfacing, 866 bridges over streams, and 136 bridges over highways to facilitate the free flow of traffic. In the interest of reducing the hazards of travel 97 rail-highway crossings were eliminated by grade-separation structures, 10 separation structures were reconstructed, and 115 grade crossings were protected by the installation of signal devices.

An additional 6,334 miles of improvements, estimated to cost in excess of one-half billion dollars, involving $281,354,647 of Federal-aid primary funds were programed during the year. Plans for many of these proposed improvements and for projects previously programed were approved as submitted by the State highway departments so that at the close of the year 7,480 miles of primary highway improvements, having an estimated cost of three-quarters of a billion dollars, were under construction or ready for advancement to the construction stage. The need of divided highways to provide greater safety for highway traffic was recognized by an increasing amount of such highway construction being included in the Federal-aid highway program.

Secondary or Farm-to-Market Roads

The Federal-aid secondary program proceeded at about the same pace as in the 1953 fiscal year. Improvements completed with Federal participation amounted to 14,995 miles as compared with 15,403 miles in the preceding year. The total of improvements constructed since the first authorization of Federal-aid for farm-to-market roads in 1944 now amounts to 95,704 miles. However, further improvements have been made on 15,359 miles already once improved in this program, resulting in net mileage improvements of 80,345 miles. Improvements of local roads not on any State highway system account for about 58 percent of the total miles improved and for about 40 percent of the expenditures of Federal-aid secondary funds.

The Federal-aid secondary system now comprises 482,972 miles, an increase of 22,970 miles during the fiscal year. The roads included were selected by the State highway departments in cooperation with the appropriate local highway officials subject to approval by the Bureau. The projects for improvement were selected and the specifications for the improvements were determined by the State highway departments and local highway officials acting in cooperation with each other, with approval by the Bureau.

Work on Outstanding Federal-aid Projects

Construction of four-lane divided highways, sections of expressways, and elaborate traffic interchanges at intersections of major arteries became somewhat commonplace during the year. Such projects were numerous, but very often only a short section of a planned improvement of considerable length was being built.

Complete control of access on major arteries was more widely adopted than in previous years but there was still much opposition to this feature, so necessary where traffic volumes are large. In some sections of the country, small cities and towns still fought to have through routes directly on the main street rather than passing close by with provision of an access road.

Typical examples of improvements made with Federal assistance under the Federal-aid program are described in the following paragraphs. Many of these projects are sections of the National System of Interstate Highways.

Kew Gardens Interchange, New York City.—Four Federal-aid projects leading toward the expanded interchange facility at Kew Gardens in the Borough of Queens, New York City, were completed. Popularly known as the "pretzel," this interchange joins Grand Central Parkway, Interborough Parkway, Union Turnpike, and the newer Van Wyck Expressway, together with connections to Queens Boulevard.

Over a span of 21 years, 26 Federal-aid projects have been involved in the development of the Kew Gardens facility, all within an area extending 2.5 miles north and south and 0.8 mile east and west. The Federal assistance in all this work amounted to about $6,594,000.

This interchange has been considered to be the most complicated interchange in existence, even prior to the addition of the lanes serving Van Wyck Expressway. In one 24-hour period the grand total flow of traffic in the many different directions amounted to 194,884 vehicles.

Sullivan Square Expressway, Boston.—Sullivan Square, the focal point of six major converging routes, has long been reputed as the site of the most chaotic traffic conditions in the Boston area. More than 50,000 vehicles passed through this square each day. The complex turning movements of automobiles, the large numbers of trucks serving this heavily industrialized area, buses and streetcars entering and leaving an adjacent busy transit terminal, uncontrolled pedestrian crossings—all contributed to a nightmare of traffic congestion.

To relieve the Sullivan Square area, a three-level expressway was completed early this year. This improvement consists of four lanes of depressed highway and tunnel, a four-lane viaduct, street-level improvements, and a pedestrian overpass. The work was carried out under difficult conditions because of the maze of underground utilities, unusual foundation problems, and the need for supporting a rapid-transit elevated structure running through the site. Traffic now moves freely and safely through this important intersection.

The Schuylkill Expressway near Philadelphia.—Through and local highway traffic approaching Philadelphia from the west must enter the city primarily via U. S. 30 (the Lincoln Highway), which is a grossly inadequate facility winding its way through narrow city streets and extending for miles through densely built-up suburbs. In 1950 the situation was materially aggravated when the Pennsylvania Turnpike was extended from Harrisburg to within 13 miles of the city limits and terminated near U. S. 30.

Prior to completion of the turnpike extension intensive studies were initiated by the State to plan better facilities leading into the city. The solution adopted was a new four- and six-lane controlled-access highway, known as the Schuylkill Expressway, to and through the heart of the city along the narrow valley of the Schuylkill River. In spite of topographical handicaps, intensified by the

Kew Gardens Interchange (the "pretzel"), New York City.

The new three-level Sullivan Square Expressway in Boston.

presence of railroads and industries along the river, flat curves and light grades prevail along the entire project, except in the heavily built-up downtown areas.

In its 18-mile length the Schuylkill Expressway has 7 traffic interchanges, 45 bridges and ramp structures, and 19 railroad and streetcar grade separations. The most westerly 6 miles have been completed as a four-lane divided facility; 9 miles of four- and six-lane capacity were under construction.

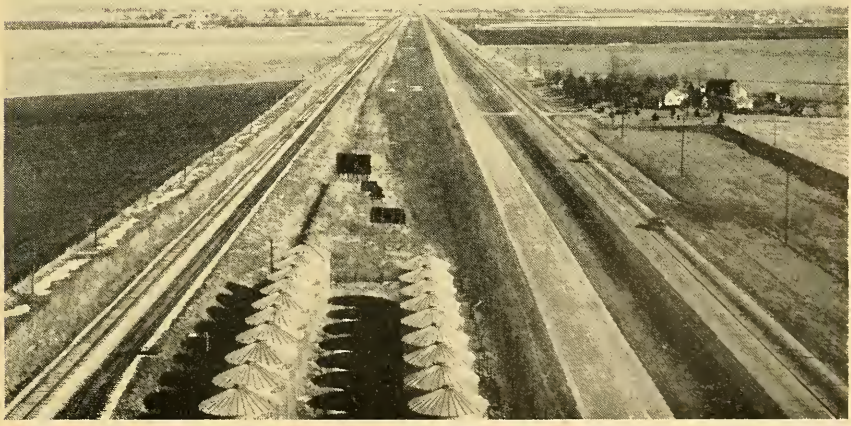
Better travel conditions will be provided for 75,000 vehicles daily by this expressway. While its greatest service will be as a distributor for the heavy local traffic to and from the central city area, its location into and through the heart of the city will also provide major relief for through travel.

Chicago-St. Louis, U. S. 66.—In 1922 it was front-page news that recent highway improvements had made it possible to travel from Chicago to St. Louis on a surfaced road. Considerable progress was made last year toward the completion of this heavily traveled route as controlled-access, four-lane divided highway. Twenty-three miles were added, built according to standards for the Interstate System.

Construction of a divided highway usually brings about a reduction in traffic accidents, and this work has done so. In the first 6 months of operation of the new section of divided highway there were 22 accidents, as compared with 40 accidents in an equal period of time when there was only a two-lane pavement.

It was expected that 140 miles of the route would be completed as a controlled-access, four-lane divided highway by the end of 1954.

The Detroit-Toledo Expressway.—Heavy commercial traffic between Toledo, Ohio, and Detroit, Mich., reached such proportions that the existing highways could no longer handle it. U. S. 24 and U. S. 25, which are combined on a single four-lane undivided pavement for a considerable portion of the distance, carried 23,000 vehicles per day, including 10,000 trucks. The constantly increasing traffic, coupled with unrestricted access to the highway, made this section one of the most dangerous in Michigan.



On U. S. 66 between Chicago and St. Louis.

To relieve this situation Michigan started construction of a toll-free expressway from the Ohio State line north of Toledo to Detroit. The projected expressway is a part of the Interstate System and will connect with the Toledo expressway system and the Ohio Turnpike. The north end will eventually connect with the Detroit expressway system. The new highway is on new location parallel to and east of the existing highways. A 24-mile section of the new route was well under way and was scheduled for completion in 1956. Thirty-five bridges were under construction. Contracts will be awarded for remaining bridges in 1954 and for surfacing in 1955.

The facility was designed according to standards for the Interstate System, including full control of access. Grade-separation structures are being provided at all railroad crossings and at important local cross roads. Minor intersecting roads will be closed. A four-lane divided pavement was being constructed, with provision for adding an additional lane in each direction when needed.

A Minnesota interstate highway improvement.—U. S. 12 is a part of the National System of Interstate Highways connecting Minneapolis and St. Paul with Milwaukee and Chicago. The 15-mile section from St. Paul to the Minnesota-Wisconsin State line carried an average of from 5,700 to 8,700 vehicles per day in 1953. During the last 5 years Minnesota, with Federal assistance, has made considerable progress toward the goal of providing a divided four-lane highway, together with grade separations at major intersections, on this 15-mile length. Previous construction has included a divided highway within and adjacent to residential St. Paul, and a bridge over the St. Croix River at the State line, built as a joint Minnesota-Wisconsin Federal-aid project to replace a narrow toll bridge.

Between these improvements there has been a 10-mile section of two-lane concrete pavement which has been badly congested. As one of the final stages of improvement of the route, a contract has been let for the construction of two additional lanes of pavement, separated from the existing roadway by a wide median. Service lanes for local movement are to be constructed so as to restrict access to the main highway to selected points.

On the section of highway already improved, the accident rate per million vehicle-miles of travel has been 1.8 as compared with 3.4 on the old road before improvement.

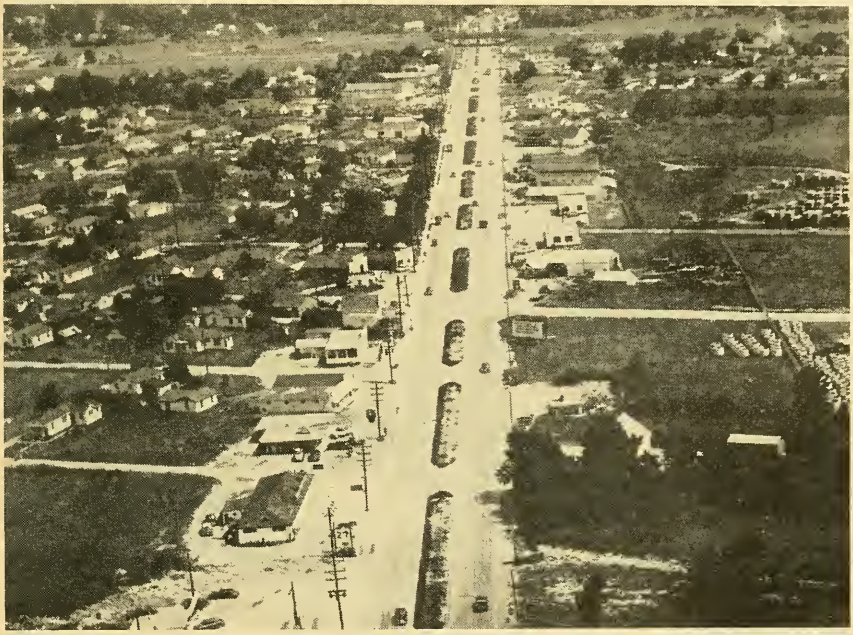
U. S. 61 in Louisiana.—U. S. 61 is the main highway leading directly north from Baton Rouge, La., and is the only connecting highway southerly to New Orleans. It passes through a heavily industrialized area. In late 1953, the highway north of the city carried 13,240 vehicles per day, of which about 30 percent were trucks and buses.

Work was begun on replacing a 1.1-mile section of badly worn two-lane road beginning in north Baton Rouge with a four-lane divided highway. Sidewalks were built where needed.

U. S. 40 in Nevada.—A section of U. S. 40 in Nevada, the Donner Summit route between Reno, Nev., and Sacramento, Calif., was constructed as a four-lane divided highway. This road is on the route taken by the ill-fated Donner party in the winter of 1846–47, and is now on the National System of Interstate Highways. Average daily traffic in 1953 exceeded 3,000 vehicles per day, with summer traffic in excess of 5,000. Only about 13 percent of the total traffic on the route was made up of Nevada passenger automobiles. The remainder consisted of about 16 percent trucks and buses, and 71 percent were automobiles from other States.

The improvement consists of separated one-way asphaltic surfaced roadways, each 36 feet in width, on easy grades and with curvature designed for safe driving

U. S. 12—Minneapolis and St. Paul to Milwaukee and Chicago.



U. S. 61 in Baton Rouge, La.

at maximum legal speed. The project extends from the California-Nevada State line northeasterly a distance of about 2½ miles.

The Harbor Freeway in Los Angeles.—Near the end of the year 2.2 miles of the northerly portion of the Harbor Freeway in Los Angeles were completed. This is one of the important freeways in California, connecting the business section of Los Angeles with its harbor at San Pedro. Important connections are made with heavily traveled interstate routes in the city. The freeway, when completed, will be 22.8 miles long, replacing Figueroa Street as a main thoroughfare.

The pressing need for a new free-flowing arterial between the Los Angeles business area and the harbor, to supplement existing congested city streets and

county roads, was quite generally recognized as long as 15 years ago. Many civic-minded individuals and organizations have played an important part in the development of the freeway, and close cooperation between city, county, State, and Federal officials has been necessary to bring to realization the hopes and dreams of the people.

Planning and design work on the freeway started about 12 years ago when plans were developed for the four-level traffic interchange at the northerly terminus of the Harbor Freeway. Determination of the most economical routing through highly developed sections of the city has presented many difficult and serious problems. Churches, schools, hospitals, commercial developments, oil wells, and refineries have all influenced the routing and in some cases the actual design and cost of the work. Relocation of public utilities, made necessary by the freeway construction, in some cases has cost as much as $313,000 per mile of freeway. It is estimated that utility relocations will cost $2,300,000 over the entire 22.8 miles of freeway. Right-of-way costs have been $42 million.

The half-way mark has now been passed in the development of the Harbor Freeway. There are completed and in use 2.2 miles, and 5.1 miles were being constructed at the end of the year. These sections include the most complex and difficult parts of the freeway. It is hoped that sufficient funds will be available to complete the freeway in about 5 years.

The Pali road on Oahu.—An increasing number of people who are engaged in the expanding economy of Honolulu on the leeward side of the island of Oahu, T. H., have their homes on the windward (northeast) side. Commuter, tourist, military, and commercial traffic used the obsolete, steep, winding road past Pali Lookout which connects the traffic artery around the island to the north boundary of Honolulu. The 5-mile route carried 10,558 vehicles per day in 1952. Its steep grades and sharp curves in some places limited the speed of a good driver to about 15 miles per hour.

The Donner Summit route, U. S. 40, in Nevada.

The Harbor Freeway and the route it relieves in Los Angeles.

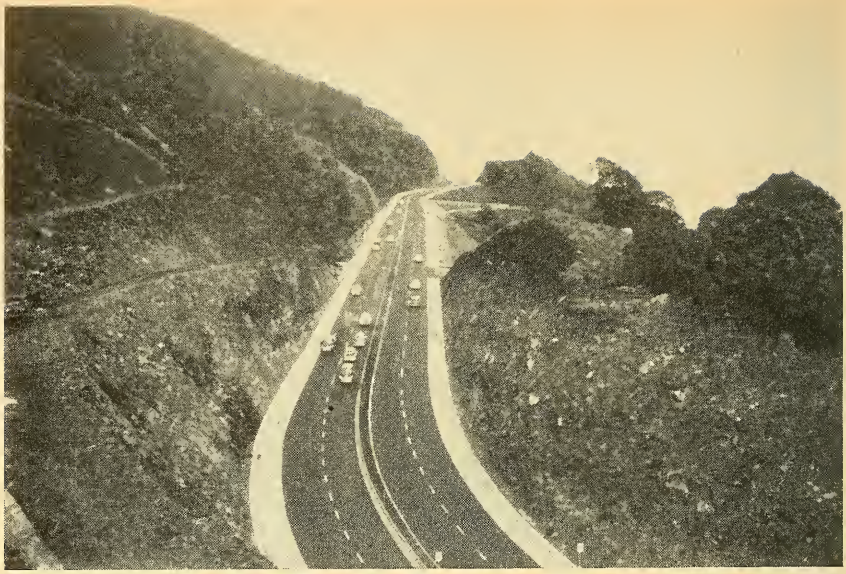
This road is now being replaced by a new route. The first section of new construction, 1.1 miles in length, was completed. It is a divided highway with the sharpest curve having a radius of 400 feet.

It is estimated that after all new construction is completed, including 1,480 feet of tunnels, the 5-mile length of the original road will be reduced to approximately 3.8 miles. Traffic is expected to increase to 14,800 vehicles per day by 1974.

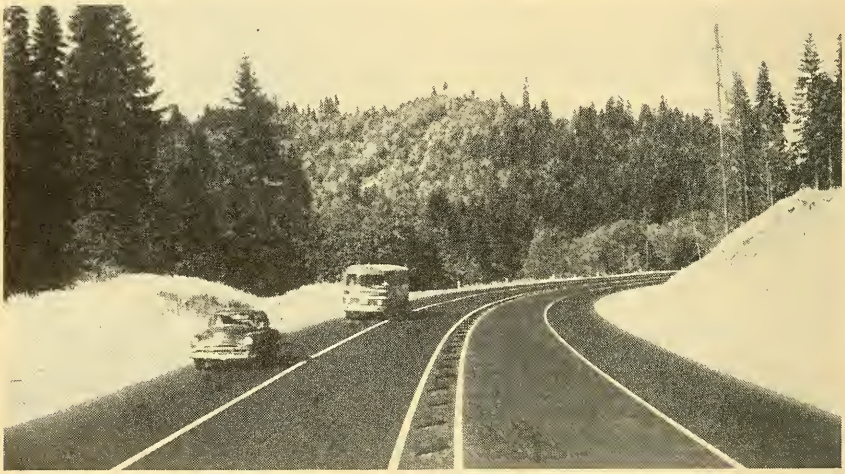
Relocation of U. S. 99 in Oregon.—As a part of a 5-year program under which 145 miles of U. S. 99 are being relocated and built with full control of access, Oregon had under construction an 89-mile section south of Eugene, extending toward Grants Pass. The construction was basically two-lane, with 24-foot pavement and 10-foot shoulders. Of the shoulder width, 4 feet was to be surfaced with asphaltic concrete. On ascending grades steeper than 3 percent, an additional paved lane was provided for slow-moving vehicles.

Right-of-way sufficient for future widening to four-lane width was being acquired and was being fenced throughout to prevent unauthorized access. Construction involves bridges at 6 crossings of the Umpqua River, 26 smaller bridges, and 57 highway grade-separation structures. There is to be no access from abutting properties and but few accesses from intersecting roads. There will be no crossings at grade.

Construction was commenced in the spring of 1952 and is planned for completion in 1958. The cost, exclusive of right-of-way, is expected to total $23,500,000. The saving in travel distance on the new route will be 8 miles.



The Pali road on the island of Oahu, T. H.



Relocation of U. S. 99 in Oregon.

Vancouver Freeway.—U. S. 99, the Pacific Highway, enters the State of Washington at the crossing of the Columbia River between Portland, Oreg., and Vancouver, Wash. The interstate bridge at this location is used by 35,000 vehicles per day. Through traffic on U. S. 99 is directed through Vancouver on commercial and residential streets, around two right-angle turns, past the high school, and by several churches. Congestion prevails throughout most of the day and is especially severe during peak hours.

Relief from this situation will be realized early in 1955 with completion of the 2.5-mile Vancouver Freeway, a four-lane controlled-access facility that extends the entire distance through this urban area.

Work on the Vancouver section of this Interstate System route was initiated

Secondary road between Truchas and Chimayo in New Mexico.

in 1951. The facility is located entirely on new right-of-way, a portion of which was formerly a part of Vancouver Barracks, a military reservation.

The first usable portion of the freeway, consisting of a railroad grade-separation structure and two highway grade-separation structures with approaches forming the traffic interchange at the junction of U. S. 99 and U. S. 830, was opened to traffic during the year.

Secondary road in New Mexico.—Most Federal-aid secondary roads are completely devoid of striking features such as large traffic volumes, notable structures, and difficult engineering problems. However, these roads are just as important to the people they serve as is an express highway to the residents of a metropolitan area. In New Mexico, residents of many small mountain towns can reach the outside world only over a single highway. Last year such a route was improved between Truchas and Chimayo. The two-lane bituminous road is 8.2 miles in length and cost $250,000. While the traffic averages only a little over 200 vehicles a day, the improvement is very important to the health and welfare of the community, as it is a regular route for school buses, mail, and commercial traffic.

Highway Improvement Under Direct Supervision of the Bureau

Under existing legislation, the Bureau receives and administers directly annual appropriations for the major highways through National forests, and performs a large amount of highway engineering and construction for other Federal agencies as required by law and as may be requested for specific projects. Expenditures during the fiscal year for highway work under direct supervision of the Bureau amounted to $38,278,442. The Departments of the Government receiving direct appropriations for the construction and maintenance of roads and calling upon the Bureau for assistance are Agriculture, Defense, Interior, and the Atomic Energy Commission.

The following tabulation indicates the volume of highway work on which the engineering and construction services of the Bureau are actively engaged (the figures include cost of work programed, in preparation, and under construction):

Bureau of Public Roads:	
Forest highways	$56,263,915
Special Tongass forest highways (Alaska)	3,081,192

National Park Service:	
Park roads	$21,561,982
Parkways	24,610,062
Forest Service:	
Forest development roads	6,626,894
Beetle control roads	5,347,780
Indian Service: Reservation roads	2,800,000
Defense Department: Access roads	3,868,480
Atomic Energy Commission: Los Alamos Road	181,000
Bureau of Land Management: Access roads	3,859,000
Alaska Road Commission: Seward-Anchorage Highway	1,522,000
Total	$129,722,305

Forest highways

Forest highways are those public highways within or adjacent to the National forests that are of primary importance to the States, counties, or nearby communities. The 24,279-mile forest highway system, largely coincident with the Federal-aid and State highway systems, is a small but highly important segment of the Nation's network of public roads. Forest highways carry most of the transcontinental traffic across the Rocky Mountains and the Coastal Ranges and provide important traffic facilities for agricultural and industrial areas in 38 States, Puerto Rico, and Alaska.

Although progressive improvement of the forest highway system has been accomplished through the years by cooperative efforts of the States, counties, and Federal Government, the condition of the system and present traffic volumes make necessary extensive reconstruction to provide the quality of service given by connecting interstate, State, and county improvements.

The Bureau completed improvements on 482 miles of forest highways during the year at a cost of $22,245,569, of which $21,027,870 were Federal funds. Table 15 of the appendix indicates these completions and reports figures for projects programed, authorized, and under construction at the close of the year. Some typical forest highway improvements are described in the following paragraphs.

Sunset Highway.—The Sunset Forest Highway, located in central Washington in the rugged Cascade Mountains, is a part of U. S. 97 and connects U. S. 2 and U. S. 10. Improvement of this route was given high priority by the State because of the through traffic utilizing Blewett Pass. The 13-mile section across Blewett Pass was extremely crooked and dangerous, and plans were made for complete relocation. Construction to cost about $1 million was begun during the summer of 1953.

North Umpqua Highway.—Located in southern Oregon along the North Umpqua River, the North Umpqua Forest Highway taps a stand of virgin Douglas fir timber of over 10 billion board feet, one of the largest single stands in the United States. Over 100 saw mills are operating in the Roseburg area, and for the most part the logs cut are hauled over the North Umpqua Highway. The highway is on the State system and in addition to its importance in timber utilization it provides local access to Crater Lake National Park and Cascades Recreational Area. About $4½ million has been spent in the postwar period on the main river road and some forest development feeder roads.

Boulder-Idaho Springs Highway.—Colorado Forest Highway Route 29 connects Boulder with Idaho Springs, 50 miles apart. The 8-mile section approaching Idaho Springs is a link in U. S. 6 and U. S. 40. The entire route affords inter-community service and is one of the most popular recreational traffic routes

in the State. In addition, the route serves mining and lumbering activities. Prior to World War II the 35 miles adjacent to Idaho Springs were improved and given a bituminous surface.

First priority in the Colorado forest highway construction program in recent years has been the completion of the 15 miles of the route adjacent to Boulder. This section traverses rugged Boulder Canyon, which presented some of the most difficult road construction in the State. Because of the magnitude of the project, work was accomplished in several construction increments at a total cost of $2¼ million. The last major section was completed during the year.

National park highways, park approach roads, and parkways

Funds for the construction and improvement of highways within or approaching National parks and monuments, and for parkways specifically designated by legislation, are appropriated to the Department of the Interior, and are administered in conformity with regulations jointly approved by the Secretary of the Interior and the Secretary of Commerce. The Bureau of Public Roads collaborates with the National Park Service in establishing systems and developing annual programs, and its engineers make surveys, prepare plans, and supervise construction of the projects.

During the fiscal year improvement of 39 miles of park highways and parkways was completed, and 173 miles were under construction at the end of the year. Typical improvements are described in the following paragraphs.

Mount Rainier National Park.—The 18.6-mile Stevens Canyon Highway in Mount Rainier National Park in Washington is a park road with outstanding scenic and recreational features. In cooperation with the National Park Service the Bureau has been working on this road since 1933. The total funds already expended and for work under way and planned amounted to approximately $4 million at the end of the year. It was expected that the extremely difficult construction required through the rock bluffs prevalent in the area would be completed in another year and the road opened for the increasingly heavy tourist traffic.

Baltimore-Washington Parkway.—Sections of the Baltimore-Washington Parkway totaling 6.8 miles were opened to traffic in October and November of 1953. The remaining 12.2 miles, approaching the District of Columbia, were opened to traffic in October 1954.

All major structures were completed at the end of the year and three paving jobs were well under way. These are the last gaps in the four-lane divided highway with controlled access between Baltimore and Washington, approximately half of which was built by Maryland as Federal-aid projects and the remainder as a Federal parkway.

The parkway was restricted by an Act of Congress to passenger traffic, and was designed according to the most advanced freeway standards.

Blue Ridge Parkway.—At the close of the fiscal year, the 477-mile Blue Ridge Parkway in Virginia and North Carolina was open to traffic for 323 miles in five major sections, as follows: From Shenandoah National Park to U. S. 60, 53 miles; from the James River to U. S. 460 northeast of Roanoke, 42 miles; from Adney Gap in Virginia to Deep Gap in North Carolina, 140 miles; from U. S. 421 west of Deep Gap to U. S. 221 near Blowing Rock, 10 miles; and from U. S. 221 at Beacon Heights to U. S. 70 near Oteen, 78 miles. The completed sections of the parkway provide access to some of the most scenic mountain areas in the east.

Of the remaining portions of the parkway, construction plans were complete for 52 miles, location surveys for 23 miles, and preliminary surveys for 52 miles.

Some of the most difficult and most expensive work remained to be done before the existing gaps can be closed.

Natchez Trace Parkway.—The Natchez Trace Parkway follows, in general, the line of the historic Natchez Trace from Nashville, Tenn., to Natchez, Miss., and will be approximately 450 miles in length when completed.

At the end of the fiscal year, a 64-mile section between Ridgeland, on U. S. 51 north of Jackson, Miss., and State Highway 12, east of Kosciusko, Miss., had been paved with bituminous concrete and opened to the public; work was under way on paving 34 miles beginning at Alabama State Route 2 and extending into Tennessee to U. S. 64; additional improvements completed consisted of 31 miles of gravel base and 34 miles of grading. Of the parkway's remaining 288 miles, plans were complete for 14 miles, location surveys complete for 89 miles, and preliminary surveys complete for 162 miles. Preliminary surveys were yet to be completed on 23 miles.

Zion-Bryce Canyon National Parks Approach Road.—Construction of a bituminous surface on 29 miles of the Zion-Bryce Canyon Parks Approach Road in Utah was begun during the year. The route is an important link in the system of highways serving the National parks and monuments in southern Utah and northern Arizona. The one-half million dollar paving project, financed with Park Service and Forest Highway funds, will cover the only unsurfaced section of the route. The resulting improvement will greatly improve travel conditions for tourists and will contribute to the general economy of the area.

Forest development roads and access roads for spruce-bark beetle control

In cooperation with the Forest Service, the Bureau, when requested, makes surveys, prepares plans, and supervises construction within the National forests of roads of importance in the protection, administration, and integration of the forests.

During the year, 47 miles of forest development roads were completed at a cost of $1,863,777. At the end of the year, 99 miles were under contract at an estimated cost of $5,749,444.

In addition to cooperating with the Forest Service in its regular road program for forest development, the Bureau provided engineers for location and construction of access roads in the spruce-bark beetle control program in Idaho and Montana. Work by the Bureau in these two States during the year involved 55 projects, covering 425 miles and costing $9 million. Progress was well advanced, though a number of projects remained to be completed at the end of the year.

Near the end of the year the beetle control program was extended to include Oregon and Washington. The Forest Service made available to the Bureau $7 million for the construction of roads to salvage beetle-infested fir trees. The work was undertaken promptly so that the infested trees could be marketed before too much deterioration occurred.

Access roads to defense establishments

Legislation of 1950 and 1952, as amended, authorized $95 million for access roads to reservations of the Armed Forces, to defense industries, and to sources of raw materials.

During the fiscal year there was appropriated $5.5 million for this purpose, raising the accumulated sum appropriated to $42 million. This was supplemented during the fiscal year by $9,991,000 which was transferred to the Bureau of Public Roads by the Atomic Energy Commission under authority of Public Law 149, 83d Congress. The Atomic Energy Commission funds permitted the financing of urgently needed improvements in the vicinity of the Commission's plants in

Pike County, Ohio, and Arco, Idaho. The regular appropriation of $5.5 million permitted the financing of other urgently needed improvements in the fall of 1953.

Steps were taken by both the Department of Defense and the Atomic Energy Commission near the close of the fiscal year to obtain legislative authority to finance from funds made available to those agencies the Federal share of the remaining projects found to be qualified under the strict criteria of the defense access-road program.

Construction in Alaska

A separate authorization in the 1950 Highway Act made available $7 million for specific highway projects in and adjacent to the Tongass National Forest in Alaska, to serve greatly increased traffic generated by the growth of a large wood-pulp industry. The special program involved construction and reconstruction of roads in the Ketchikan, Juneau, and Sitka areas. All projects in the program were under way with the exception of 4.4 miles in the Juneau area, for which a contract was soon to be awarded.

Access roads to lands supervised by the Department of the Interior

The Bureau cooperated with the Bureau of Land Management of the Department of the Interior in its extensive program of road construction in the Smith River area in the northeastern portion of Douglas County, Oreg., to salvage spruce timber being attacked by bark beetles, and to provide access to the area for subsequent logging operations. Road surveys were made under extremely difficult conditions, since the region has a heavy rainfall and there were no existing roads or trails.

At the end of the year, 42 miles of highway and 4 bridges, to cost $2,882,000, were under construction. Surveys and plans for additional work were being completed as rapidly as possible.

Indian reservation roads

Under agreement with the Office of Indian Affairs of the Department of the Interior, the Bureau supplies general supervision in the establishment of master road plans for each Indian reservation, preparation of long-range programs, location of roads and bridges, preparation of plans and specifications, and supervision of construction. At the end of the year, 280 miles of Indian reservation roads were under construction at a cost of approximately $2,780,000.

Highway Design Standards

There is real need of highway design standards adequate for modern traffic which can be developed under conditions leading to their general adoption and thus assure greater uniformity in the quality of highways. For some years Bureau representatives have been working with design specialists of the State highway departments in modernizing guides for design of highway features such as width, grades, curvature, etc. The group is known as the Committee on Planning and Design Policies of the American Association of State Highway Officials. After considerable study of design practices of the States and of research on driver behavior and traffic operation, a treatise on design guides was prepared and has been adopted by the Association. It is anticipated that the new design criteria will lead to higher standards in some instances and will promote uniformity in quality of highways generally. The adopted policy, entitled *A Policy on Geometric Design of Rural Highways*, was published by the Association.

Bridge Design

The Bureau published *Standard Plans for Highway Bridge Superstructures* and arranged for its sale by the Superintendent of Documents. These standard plans show complete details for various types of bridge superstructures. They are intended to serve as a guide to State, county, and local highway departments in developing designs for bridges of adequate strength and economical proportions for primary, secondary, and urban highways. The plans were expected to be particularly valuable to small highway departments with limited engineering staffs.

Use of prestressed concrete in highway bridge construction has been growing in favor. In many situations the method permits large savings in materials. It has become increasingly evident that prestressed concrete can compete in many instances with the older types of construction. Since issuance of design criteria for prestressed concrete bridges in 1952 by the Bureau, there has been an insistent demand for a more complete specification to cover a wider design application, together with construction and materials requirements. Revised and expanded criteria are being prepared for publication.

The use of welding in steel bridge construction has continued to increase, and an important goal was reached during the year by steel producers when they developed a weldable steel for bridges. Largely through the efforts of the Bureau, the steel industry developed a specification for a weldable steel that has been adopted by the American Welding Society and the American Society for Testing Materials. The availability of the new steel will undoubtedly encourage designers to take greater advantage of the savings in weight of steel and the greater margin of safety possible where welding is suitable.

The Bureau encourages research in structural problems related to bridges. It cooperates with and gives financial support to State highway departments, universities, and other research organizations in making investigations for which there is important need. Through research, new methods and procedures are developed for the design and construction of safer and more economical structures. Sixteen reports were made available to bridge designers by cooperators during the year.

In connection with foreign assistance programs, designs were prepared for major bridges in the Philippines and Ecuador.

Joint Planning of Location of Highways and Airports

Cooperation in planning the location of highways and airports and the extension or improvement of those existing, to assure safety to the traveling public, has made good progress. Under the Federal-aid Highway Act of 1944, Federal funds may be spent for improvement of highways which provide access to airports, if the Bureau and State highway departments concur with officials in charge of the airport that the proposed airport and highway are in the public interest.

During the year the Civil Aeronautics Administration limited its cooperative activities to those civilian airports previously improved with Federal funds. This resulted in State aeronautical commissions and local aeronautical authorities taking a more active part in working out plans for the coordinated improvement of airways and highways.

Regulations of the Department of Defense assured that the planning of new military airports or extension of existing facilities will have full coordination of the commanding officer, the Bureau, and the State highway departments. Similarly, no public highway improvements were made within the vicinity of a military air facility until the Bureau had arranged for coordination between

the commanding officer of the facility and all highway officials having an interest in the highway.

The objective of preventing and eliminating conflicts between airway and highway facilities, eliminating unnecessary use of Federal funds for either or both types of facilities, and assurance that the final plans agreed upon were in the public interest, was attained.

Repair of Flood-Damaged Roads

For many years it has been the policy of the Federal Government to aid the States in the repair or reconstruction of highways and bridges damaged or destroyed by floods and other disasters of extraordinary character and extent. In recent years such aid has been available under authorizations permitting the use of available emergency funds without waiting for legislative action following each disaster. Legislation of 1951 authorized $15 million for this purpose and limited its use to routes on the Federal-aid systems. Legislation of 1952 provided a continuing authorization of not to exceed $10 million annually for this purpose.

Allocations of emergency funds totaling $1,974,541 were made during the fiscal year to four States for rehabilitation work estimated to cost $3,949,082. Of the total amount of emergency funds allocated, $667,651 was for the repair of flood damage that occurred in May and June 1953 in Iowa and Montana, with Iowa receiving $538,900 and Montana $128,751. Louisiana received $669,390 and New Hampshire received $637,500 for the rehabilitation of flood damage sustained in May 1953 in Louisiana and in March 1953 in New Hampshire.

During the latter part of June 1954 disastrous floods occurred in Iowa and Texas. It was anticipated that these States would request allocation of emergency funds for the repair and reconstruction of damaged roads and bridges included in the Federal-aid systems.

Foreign Activities

Prior to World War II, the foreign activities of the Bureau were limited almost entirely to work on the Inter-American Highway as authorized by specific legislation and under the guidance of the State Department. There was occasional participation in an international highway conference, and in a few instances a representative acted for a short time as adviser to a foreign government on highway matters.

Since the war, activity has been greatly enlarged to include education of foreign visitors in our highway practices, supervision of substantial highway aid programs in underdeveloped countries, and giving advice and assistance after study by one man or a small task force. Formal negotiations with foreign governments, granting of loans, and allocations of funds have been the functions of other Federal agencies. The Bureau has acted in an engineering capacity only.

In manning these operations, it is necessary to send men thoroughly experienced in the field in which they are to operate. The purpose is to train residents of the several countries in highway engineering and machine-operation methods as rapidly as possible and leave them to carry on what is expected to be a growing highway program. The Bureau has drawn upon its more experienced men and those of State highway departments for foreign assignments.

A control section has been established in the Washington office to correlate administrative handling of all foreign projects.

The Inter-American Highway

Since 1930 the United States, through the Bureau of Public Roads, has been assisting the Republic of Guatemala, El Salvador, Honduras, Nicaragua, Costa

Rica, and Panama in the construction of the Inter-American Highway, which is that section of the Pan American Highway from Nuevo Laredo, on our Mexican border, to Panama City, at the Pacific terminal of the Panama Canal—a distance of about 3,200 miles.

In June 1954, 94 percent of the Inter-American Highway was passable in all kinds of weather by motor vehicles, but uninterrupted travel to Panama City was still an impossibility. Throughout its length of about 1,600 miles in Mexico, the highway was open at all times and practically all of it was paved. The section of the highway in Mexico has been financed and constucted entirely by the Mexican Government.

In Guatemala, starting at the Mexican border, there was an impassable gap of 25 miles. After this gap, the highway was passable under all conditions through Guatemala, El Salvador, Honduras, and Nicaragua, to the northern boundary of Costa Rica, a distance of about 815 miles. In this distance there were many sections on which considerable construction will have to be done to bring the highway up to ordinary modern standards for a two-lane road, but the route was open and passable without great difficulty.

At the northern border of Costa Rica there was a short gap of 13 miles which was not passable but which should be opened to traffic in the spring of 1955. From this short gap for about 266 miles to San Isidro, south of San Jose, the capital of Costa Rica, the highway was good for the most part.

Beginning at San Isidro, the last and by far the most imposing impassable section of the highway, in southern Costa Rica and northern Panama, remained to be constructed. This gap, which reached as far as Concepcion in Panama, a distance of approximately 145 miles is in rough country and will take several years to open, provided funds are made available. From Concepcion to Panama City, a distance of 320 miles, the highway was passable at all times but much work will have to be done to reach acceptable modern standards for a two-lane road.

During the fiscal year, the United States provided $1 million to continue cooperative work on the Inter-American Highway.

Surfacing was begun on the only remaining part of the highway in El Salvador that is not paved. This 21-mile section has been passable at all times since 1948.

In northern Nicaragua, construction of the most important bridges between Sebaco and the Honduras border was continued. Three bridges were completed, two other bridges were placed under construction, and plans were completed for six additional bridges. Equipment purchased during the previous year was put to work to improve to modern standards the low-standard section of the highway in northern Nicaragua, from the Honduras border south to Sebaco. In southern Nicaragua, between Rivas and the Costa Rica border, surveys were begun as the first step toward replacement of 10 temporary bridges with permanent structures.

In Costa Rica, good progress was made toward eliminating the impassable gap in the northern part of the country. About 35 miles of all-weather road were constructed near the Nicaragua border. At the end of the fiscal year only 13 miles remained to be constructed to remove another barrier to international transportation in Central America. In the southern section of Costa Rica, work started last year on the survey of the impassable gap was suspended for lack of funds. During the year six major bridges were completed, work was started on three more, and plans were completed for six additional bridges.

In Panama, the project for 25 miles of grading, base course, and bridges, from David south, was completed and the concrete paving was half completed.

No cooperative work was done during the past year on the Inter-American Highway in Guatemala and Honduras.

Other Latin American projects

In El Salvador the Bureau furnished engineering aid and assistance, at the request of the Government of El Salvador, in the design and construction of several railroad grade-separation structures on the road from San Salvador to the Ilopango airport. At the end of the year this project was suspended.

Engineering assistance was furnished in connection with studies made by the International Bank for Reconstruction and Development looking toward the improvement and construction of the Pacific Highway, a route roughly paralleling the Inter-American Highway but near the Pacific Ocean. In previous years assistance was given to El Salvador in the design and construction of the Lempa River bridge at San Marcos, the largest bridge on this route.

In Honduras a Bureau engineer gave part-time engineering assistance in the construction of the 80-mile "Highway of the South" from San Lorenzo, a Pacific port, to Tegucigalpa, the capital.

In Nicaragua the Bureau continued its technical assistance in planning and construction of a national highway system (other than the Inter-American Highway) which is being financed in part by a loan from the International Bank for Reconstruction and Development. One additional technical assistant was sent to Nicaragua for this work.

The Rama Road in Nicaragua, when completed, will form the main transportation link between the settled portion of Nicaragua on the Pacific Coast and the large undeveloped fertile areas of eastern Nicaragua. It begins at San Benito on the Inter-American Highway and extends 158 miles to Rama, a river port reached by ocean vessels from the Atlantic Ocean. Construction began on this project in 1943 with United States funds and continued until June 1948 when work was suspended due to lack of funds. The project was then about half complete. During the fiscal year Congress appropriated $1 million for the Rama Road, and work has been resumed. Plans were made to have some of the work done by private contractors after competitive bidding and award to the low bidder. The work done previously was by the Government of Nicaragua with their own forces and equipment, which has been the customary procedure in that country.

In Ecuador the Bureau continued its technical aid on the 115-mile highway to connect the new port of Manta with Quito, the capital. Designs were made and plans furnished for three large bridges, and assistance was furnished in supervising construction of the highway.

Representatives of the Bureau attended meetings of committees at Mexico City, Lima, Peru, and Washington, D. C., in preparation for the Sixth Pan American Highway Congress, and attended the Congress held at Caracas, Venezuela, in July 1954.

Activities in Turkey

The program of assistance to Turkey in building a modern highway system, launched in 1947, has produced striking evidence as to what improved highways will do for a nation that had been almost entirely without them. Seven years ago the highway department of Turkey barely justified the name, and highway transport was by cart and pack animal. In 1953 trucks were in general use on main highways and a well organized highway department, manned by Turks, was engaged in improving highways with modern equipment.

In this program the United States has provided approximately $41 million which has been used for the purchase of equipment and in technical training. The Turkish Government has supplied $190 million for construction. During the year 25 American specialists acted as advisers and training instructors.

Turkish authorities constructed 1,682 miles of highways during the past year—

an increase of 496 miles over the previous year—and maintained 11,580 miles of the National System by machine methods.

The introduction of machine methods of construction and maintenance has been completely successful. Men trained by Bureau representatives operated trucks, tractors, and other road machines throughout Turkey. They also manned 10 fully equipped division repair shops and 28 maintenance garages.

Growth of traffic indicates the effect the highway program has had on the Turkish economy. There were about 8,900 motor vehicles in 1945 and 60,000 in 1954. The change is due almost entirely to the increased mileage of improved roads. The most pronounced effect has been the increase in freight hauling by trucks and the consequent reduction in costs. In 1949 the average cost of transporting freight between 10 representative cities throughout Turkey was equivalent to 15.2 cents per ton-mile. At the end of 1953 it was 8.6 cents, a decrease of approximately 43 percent. Travel time between these cities has been reduced almost 50 percent. More and more, the interior of Turkey has been opened up to modern commerce. Since 82 percent of Turkey's population lives in scattered, small villages, the effect of this penetration is obvious—increased incentive to grow surplus crops to sell in other areas and to the outside world, and increased purchasing power with consequent increased demand for manufactured goods to raise the standard of living.

A major benefit of the improved roads is the military value of highway transport in defending the borders of Turkey.

Activities in Ethiopia

The third year of assistance to Ethiopia in rehabilitating and supplementing existing main highways produced substantial results. The Imperial Highway Authority, staffed in part with 35 engineers and equipment specialists from the United States, supervised improvement of a 3,100-mile road system. Costs of the program were to be met entirely by Ethiopia with approximately $10 million from Ethiopian sources and a loan of $5 million from the International Bank.

Major improvements have been made on all roads in the 3,100-mile network with the exception of one 190-mile section assigned a low priority. All but 310 miles of the network had an all-weather surface.

Reconstruction of the 535-mile main road from Addis Ababa to Assab on the Red Sea was virtually completed, reducing travel time for trucks from 2 weeks to 2 or 3 days. Similar progress has been made on the 205-mile primary road from Addis Ababa to Jimma, the principal outlet for a rich and extensive coffee area and site of a newly established agricultural school. When the highway rehabilitation program started the road was virtually closed to passenger traffic, and the normal travel time for trucks was from 3 days to a week. Today the trip is made in 6½ hours by passenger car and in 10 hours by truck. Long sections of entirely new road have been built on the route from Addis Ababa to Dilla in a rich, coffee-producing area. The 230-mile trip, which formerly required as long as 5 weeks, is now an easy day's drive.

Daily bus service provided quick transportation between Addis Ababa and Jimma at a cost of about $5 for the 205-mile ride. Bus service radiated in five directions from Addis Ababa, on daily and biweekly schedules and at reasonable cost, for the thousands of passengers whose alternate means of transportation is by foot or mule.

Even with the vast improvement of primary roads already accomplished, there were definite breaks in the transport system between farm and market. In most areas, produce such as coffee, grain, hides, and fiber still had to be transported by donkey from farm to regional market centers. From these centers it moved to Addis Ababa and the ports of Assab or Massawa by truck. As the fourth-year work began, plans were being made for a long-range development program to assure further economic and social benefits to the empire.

Activities in the Philippines

At the conclusion of the program of highway rehabilitation in the Philippines on June 30, 1952, the Economic Cooperation Administration (now Foreign Operations Administration) requested that Bureau personnel remain in Manila as consultants to the Philippine Government on a program of highway improvement and development. A staff of 10 Bureau engineers and technicians undertook this work. This staff was being increased to 16 at the end of the fiscal year.

The primary objective of the highway improvement and development program was to assist the Philippine Government to form a well organized and efficient highway division capable of planning, designing, constructing, maintaining, and operating a system of national, provincial, and secondary roads to serve as the backbone for the economic development of the country and for the needs of national defense.

The first phase of the program was to provide for the construction of a system of new roads on the island of Mindanao, to open up vast new areas of agricultural land. Work on this system, comprising a total of 356 miles, was started during the first year and progressed on schedule during the past year, although severely hampered by dense vegetation, heavy tropical rains, and jungle clays that made construction difficult. A total of 135 miles had been let to contract for construction, and construction started on an additional 49 miles at the end of the fiscal year.

A nationwide program of highway improvement and maintenance has been initiated and is gathering momentum. Maintenance operations were being mechanized rapidly as new equipment was received. Mechanization was resulting in increased road improvement for each Philippine peso expenditure.

In assisting the Philippine Government it has been necessary to provide material aid in the form of highway equipment and bridge steel. A total of $16,750,000 for equipment, steel, shop tools, training aids, and personnel has been provided by the United States. The greater part of this amount ($14,311,629) was allocated for equipment and shop tools.

Thousands of miles of Philippine highways were in need of an asphalt surface to reduce the high transportation costs and permit resettlement of farming areas remote from central markets. To meet this need several units of asphalt-

Philippine family entering the jungle in search of a homestead to be made accessible by a new road. Clearing for the road has begun.

ing equipment were delivered and an expanded program of asphalt surfacing initiated.

Two major equipment depots constructed at the beginning of the program were expanded and better equipped to handle new equipment being received and to rebuild war-surplus equipment left in the Philippines by the Armed Forces. Both depots have been well equipped to serve as training centers for mechanics and operators.

The training courses initiated previously were continued throughout the year, and 250 men were trained. On-the-job training of engineers continued, with considerable time being given by Bureau technicians to preparation and printing of several technical manuals for use by Philippine engineers.

The Philippine Government, in implementing the overall program, reorganized its highway division, enacted basic highway legislation, and made full use of equipment delivered.

Activities in Liberia

The highways of Liberia comprise approximately 900 miles of scattered sections of road. Many of these are only improved trails. About 200 miles are within large rubber plantations. The possibilities for development in the interior of Liberia are great, and construction of a highway system is considered essential to the country's progress. Coffee, cocoa, rice, palm oil, and tropical fruits can be grown over a large part of the country. Liberia's mineral wealth is largely unexplored because of the difficulty of access, and the products of the vast forests have hardly been touched.

The Bureau, in connection with the program of the Foreign Operations Administration, has cooperated with the Liberian Government in establishing a division of highways and in carrying out a limited construction program. During the year the Bureau staff in Liberia consisted of six engineers and two equipment specialists. Liberians were trained in all phases of operating a highway organization. The effectiveness of the training program was apparent from the number of Liberians filling responsible positions. During the year the positions of chief engineer and materials engineer, formerly filled by Bureau personnel, were occupied by Liberians. Liberians trained by Bureau personnel filled all accounting and stenographic positions, and many of the subordinate engineering positions. A Liberian acted as superintendent of the newly created maintenance department and was expected to be capable of assuming complete charge of maintennace in approximately 2 years. A Liberian also succeeded to the position of shop superintendent, and good progress was made in training Liberian mechanics.

The construction program consisted of projects to connect the Ports of Monrovia and Harper with the interior. Fifty-six miles were under contract and bids were to be received soon after the end of the year on an additional 70 miles. Bids were received for construction of an equipment depot in Monrovia. A survey 123 miles in length was completed under an engineering contract, and plans for construction of this route were substantially complete.

The importance of highways to Liberia is evident from the increase in traffic wherever highway improvements have been made. A large part of the traffic is made up of trucks carrying products of farm and forest from the interior of Liberia, and from adjacent French territory, to the coast. The demand for farm-to-market roads will make highway construction a continuing activity and a continuing need in Liberia for many years to come.

Activities in Jordan

Since 1952 the United States has assisted Jordan on a small scale in introducing modern highway methods. At first, Bureau engineers stationed in Turkey

were sent to Jordan for short periods. In December 1953 a Bureau engineer was stationed in Jordan to supervise construction of demonstration roads totaling 52 miles in length. He has held numerous short courses for engineers, prepared typical plans and specifications for use of the Department of Public Works of Jordan, and trained operators of bulldozers, motor graders, cranes, and other road equipment. The United States has supplied equipment costing $130,000. However, much of the grading was done by hand methods.

As yet there is only a small beginning in highway improvement but there is reason to believe that larger programs will develop.

Other Foreign activities

A Bureau specialist was sent to Turkey to advise as to the best approach to a study of the often proposed crossing of the Bosporus by bridge. He also suggested further study in regard to improvement of existing ferry facilities and improvement of traffic routing in Istanbul.

A representative from the Bureau's Philippine division was a delegate to the September 1953 meeting of the United Nations Economic Commission in Bangkok. Two engineers from the Philippine division examined local conditions and efforts toward road construction and maintenance in the Associated States of Indochina, and prepared recommendations in regard to highway matters for the United States' assistance mission handling aid to those countries.

An engineer from the Bureau's division office in Turkey was sent to Afghanistan for a 3-month survey of highway problems, and 2 engineers were sent to Jordan to advise on highway location.

Foreign Visitors

Training programs were provided by the Bureau for 61 highway engineers from other countries, sponsored by the Foreign Operations Administration and the United Nations. Assistance was also provided in preparing programs for 11 individuals who came to the United States under the auspices of their own governments, or who were referred to the Bureau by other government agencies for a portion of their training program. Assistance was given the Foreign Operations Administration in the preparation and carrying out of a program for a group of 32 highway traffic engineers and administrators from 11 European countries. Seventy individuals classified as casual visitors were aided for short periods of time ranging from a few hours to 1 or 2 weeks.

State highway departments and a number of county and city highway departments gave valuable assistance by accepting visitors and showing them highway methods and procedures in detail. The large number of highway engineers and officials visiting this country is an indication of the worldwide interest in our methods and equipment for highway improvement.

Highway Safety Activity

The Bureau continued to assist in the program to advance the cause of safety on the streets and highways, as required by law.

Cooperation was continued with five national organizations in furtherance of the official action program for highway safety.

Staff assistance, printing, and supplies were made available for planning and conducting the White House Conference on Highway Safety in February 1954, under the general chairmanship of the Secretary of Commerce.

Similar service was provided for the President's Action Committee for Traffic Safety, the first continuing action group ever created by Presidential appointment following a national traffic-safety conference. The group was established to coordinate activities of various autonomous national organizations in the

traffic-safety field, and to promote effective citizen support, at the community level, for proved methods of improving street and highway safety. Committee membership consisted of the seven active group chairmen of the White House Conference, representing agriculture, business, labor, media, civic and service organizations, public officials, and women.

The 1954 White House Conference and the subsequently appointed Action Committee had their inception at a meeting of the President with 28 national business leaders in July 1953. Traffic fatalities, always heavy, had been increasing year by year for more than 3 years. A tremendous step-up in the traffic-safety program was imperative.

Preliminary evidence indicated that the increased efforts to save lives have been successful. Nearly 700 fewer people were killed by motor vehicles during the first 5 months of 1954, compared with the same period a year earlier. If this downward trend is maintained, 1954 will be the first year since 1949 that motor-vehicle deaths have declined.

Financial and Administrative Research

Administrative studies

Research work carried on in the administrative field during the year continued to be largely cooperative and consultative in nature. At the request of State officials, and in cooperation with the Automotive Safety Foundation, studies of highway organization and management were conducted in Louisiana, Minnesota, and West Virginia. These studies required on-the-ground discussions with central-office and field officials of the State highway departments and with local road and street officials, and involved detailed analyses of operating practices and procedures. Consulting services were furnished to Maryland in connection with a proposed reorganization of the Maryland State Roads Commission.

Previously, research work in the administrative field was confined almost exclusively to the State and local rural governments, with little accomplished at the urban level. During the year an outline for a proposed study of the administration of highways and streets in metropolitan areas was completed. Work on the study itself was delayed pending a decision as to how it might be correlated with work on urban problems recently undertaken by other agencies.

Highway laws

Cooperative study of highway laws was continued under the direction of a special committee of the Highway Research Board. As an aid in this work of legal analysis, the entire field of highway law was subdivided into 26 major topics. Substantial progress was made on three of these during the year: A detailed analysis of State constitutional provisions affecting highways was completed; a study of statutory provisions of the States relating to highway system classification was well advanced; and a study of declarations of legislative policy relating to highways, as they appear in State statutes, was in progress.

Financial studies

Local road and street finance data were reported for all States. As an adjunct to the street finance reports, the States also reported the receipts, expenditures, and debt information for parking meters, publicly owned parking lots and garages, storm sewers, street cleaning, street lighting, and curbs and gutters.

A historical bulletin covering the highway finance activities of local rural units for the years 1942–47, completed in 1953, was revised during the year to include the years 1948–51, and was nearly ready for publication. Work was continued on an urban street finance bulletin covering the years 1941–51.

The annual highway finance report of receipts, expenditures, and debt status of all governmental units for highway purposes for the years 1945–52 was pre-

pared and published. Also published was a preliminary report showing corresponding estimated data for 1953 and a forecast of highway activities for 1954. A review of developments in highway finance during 1953 was prepared and made available to interested groups for publication.

Section 13 of the Federal-aid Highway Act of 1954 directed the Secretary of Commerce to make "a comprehensive study of all phases of highway financing," including a determination of the costs of completing the highway systems in the several States as well as an intensive study of the toll-road movement and its implications with respect to Federal highway policy. The study was set in motion toward the end of the fiscal year. Cooperation of the 48 States, the District of Columbia, Hawaii, and Puerto Rico was enlisted through the assistance of the American Association of State Highway Officials, as well as through direct contact by the division and district offices of the Bureau. Two lines of inquiry were planned, one on the needs and costs of an adequate program of improvement of all road and street systems, and the other to provide information on the extent of feasible toll roads. Field representatives were called to Washington to be briefed on the requirements of the section 13 project and to participate in final planning of the inquiries. At the very close of the fiscal year the project was launched, with the expectation that all States would cooperate in a prompt and thoroughgoing response to these inquiries. A report based largely on the information given by the States will be prepared and submitted to Congress not later than February 1, 1955.

Taxation studies

A comprehensive analysis of the problems of highway taxation was continued during the year in cooperation with the committee on highway taxation and finance of the Highway Research Board. Work on this project may be classified under the following three headings: (1) Analysis and appraisal of the existing methods and bases of taxation for the support of highways, (2) study of theories and methods for the equitable allocation of highway costs between motor-vehicle and nonmotor-vehicle tax sources, and (3) study of theories and methods for the equitable allocation of motor-vehicle tax responsibility among vehicles of different types and sizes.

A study of highway-user taxes paid in 1952 by vehicles in different type and weight groups was completed and published. A study of the variation of highway-user taxes with vehicle size for selected vehicles in intrastate operation was nearing completion. A pilot study of the taxation of interstate and transstate vehicular movements, based on selected vehicles operating over a specified route covering three States, was made during the year. A tentative outline of procedure for a similar study covering 48 States was prepared.

Analyses of the kinds of highway taxes in use and the bases upon which they are imposed, and study of the incremental method of motor-vehicle tax allocation were continued. Assistance was given in the financial and tax study made by Louisiana State University for the Louisiana Legislative Council and the State Department of Highways. Assistance was also furnished the Missouri Highway Department in a study of the allocation of highway costs in that State by the incremental method.

Highway cost studies

The study of highway costs was continued with the cooperation of numerous State highway departments. Annual cost research involves the determination of present and future costs of short-range and long-range highway improvement programs. Essential features of this work are the uniform assembly of construction and maintenance cost and mileage data and the analysis of these data to evaluate causes of road retirement, rates of depreciation, and annual costs by road types, routes, and systems.

Analyses of the service-life characteristics of highways were continued during the year. This work was based on construction and retirement data as of January 1, 1953, submitted by 21 States and Puerto Rico.

Advances were made in the study of highway investment, particularly in the application of investment life and depreciation data in estimating future highway needs. The concept was developed that the trend in the depreciated value of the highway investment should keep step with the trend of traffic and with general economic indices such as the gross national product. The data on highway needs which will be derived from the study called for under section 13 of the Federal-aid Highway Act of 1954 will provide means of testing the validity of this concept.

Studies of selected road sections were continued in the endeavor to determine the effect of traffic volumes and weights on the condition and cost of highways. Attention was directed particularly to costs. Data were submitted by 26 States for 255 control sections. Of this total, 150 control sections representing 1,545 miles of road have been analyzed.

Assistance was given West Virginia in selecting highway sections for study. Cooperative work with State highway departments on a manual of procedure was completed, and the manual was published by the Highway Research Board. Assistance was also given to Washington, West Virginia, and Wyoming in furtherance of the comprehensive studies of highway needs in those States.

In the course of the work on the West Virginia needs study, a report was prepared on the capital investment in the West Virginia primary system of rural roads. Basic data on highway construction, retirements, needs, and costs were analyzed with the objective of developing costs of alternative highway improvement programs. Seven alternate construction programs were subjected to study and evaluation. This work has general value as a case study in the analysis of highway investment.

Production cost studies

During the two preceding fiscal years, cost studies of work performed by contract and by State forces were made in North Carolina. Five farm-to-market road projects were involved—three constructed by the contract method and two built by State forces. Work on the various project reports and on cost comparisons was started in July 1953 and continued throughout the year.

A field study was continued of the cost of surface maintenance of selected sections of bituminous roads in western States. These studies included unit costs for labor, equipment, and materials and have been made in eight States. Basic data developed were to be used in interpreting the physical maintenance work on the WASHO test road at Malad, Idaho, in terms of normal work and cost when performed as a routine maintenance operation.

All field work and most of the final analysis was completed on a northern California forest highway project to determine the additional expense of permitting traffic to pass during construction operations. No alternate routes were in the vicinity and construction of a detour would have involved considerable expense. It was considered cheaper to maintain traffic during construction, and the job was let to contract on that basis. Study findings lend support to the decision made on this job.

A study of costs on grading and surfacing work was started on an eastern Washington project. The contract for the work includes a provision for maintaining traffic during construction, and costs thus incurred will be determined for each bid item.

Cost studies were started on three Montana projects involving one-bin and two-bin plant-mix surfacing to aid in determining the relative advantages of various types of surfacing work.

Studies of equipment performance and production rates were conducted on six construction jobs in three States. Summaries of 140 jobs on which equipment performance studies have been conducted revealed, among other things, that delays of less than 15 minutes each to key equipment absorb an average of 16 minutes out of every working hour. On some jobs nearly half of the working time was consumed by small delays. Delays greater than 15 minutes each to key equipment were found to average about one-fifth of the scheduled working time but varied greatly between jobs. The largest single source of delays common to all classes of equipment involved the repair and maintenance of the equipment itself.

Land acquisition, roadside control, and terminal facility studies

Studies of problems connected with the acquisition of highway right-of-way, protection of the roadside, access control, and the provision of terminal facilities continued during the year, independently and in cooperation with State highway departments and national organizations.

Factual analysis of State statutes pertaining to the placement, regulation, and relocation of public utility installations in and along highway rights-of-way was continued. This analysis will constitute a part of the report which the Secretary of Commerce was directed to make in cooperation with the State highway departments and other parties in interest, under the terms of section 11 of the Federal-aid Highway Act of 1954.

Studies of ways and means of reserving land for future highway right-of-way purposes advanced during the year. Analysis of methods and devices used effectively by various State and local governmental units was partially completed.

Substantial progress on a study of free expressways was made during the year, when the last of the returns of a questionnaire on the subject were received. These indicated that over 3,200 miles of expressways were completed or under construction in the United States.

A joint project of the American Municipal Association, the Highway Research Board, and the Bureau of Public Roads relating to parking meter practices was completed and a comprehensive report published by the Highway Research Board. It contains extensive data relating to the number of meters, their financing, revenues, installation, maintenance, policing, costs, legality, and related matters.

Previous research concerning parking legislation was in process of being brought up to date.

Requirements for the provision of parking accommodations contained in zoning ordinances was also in the process of being made current. A series of comprehensive tables by types and uses covering all requirements was being prepared.

Assistance in connection with the legal, financial, and administrative phases of parking surveys was rendered to municipalities where parking surveys were made and assistance was requested. This aspect of parking surveys is assuming greater importance than formerly. The parking needs as determined from prospective users are unlikely to be provided unless the program is implemented by appropriate legal, administrative, and financial tools.

Highway Transport Research

Road inventory and mapping

Information on rural roads and main city routes was brought up to date in 43 States and Puerto Rico through the continuation of road inventory operations. The data obtained are valuable in determining needs and deficiencies of the road network in each State and are necessary in appraising the performance and adequacy of the Nation's several highway systems. Statistical summaries thus

obtained provide a major part of the necessary tools used in determining policies for administration of highway programs and long-range planning.

During the year, 277 county general highway maps were completed and submitted by 32 States. Other mapping activities resulting from cooperative planning surveys with the States included the preparation and publication of 2 State general highway maps, 29 State traffic maps, 831 county traffic maps, and 247 maps of incorporated places.

Traffic volumes and truck weights

Under agreements for traffic studies with Federal assistance, every State has developed some information concerning the growth in traffic in the past year compared to growths in previous years. Forty-one States submitted reports giving data collected in the summer of 1953 at stations used for the past 12 years to determine trends in loading practices and weights by vehicle types, to be used in computing carried loads and ton-mileages. Possibly a more important use has been determination of the effectiveness of State law enforcement and relative conformity with the recommendations of the American Association of State Highway Officials. Data were obtained at approximately 500 stations. Analysis of the data was begun.

Traffic in rural areas during the fiscal year increased at about the same rate as in previous years with only a slight indication of leveling off. At the same time, traffic in urban areas increased somewhat faster than it did in the rural areas. While all rural travel increased approximately 5 percent, urban traffic apparently increased about 6 percent.

In addition to the annual summer weight survey, 10 States collected data seasonally at selected stations, as was done in the previous 3 years. These surveys were made in order to determine the variations in vehicle types and weights and the frequencies of heavy loads in different hours of the day, days of the weeks, and seasons of the year. Such information is useful in establishing a relation between frequency of heavy loads and pavement damage under different circumstances. Analyses were made by the Bureau of the variation of weights by vehicle type for different hours, days, and seasons in order to establish a factual basis for the development of more economical sampling procedures.

Motor-vehicle-use studies

Motor-vehicle-use studies being conducted in cooperation with the State highway departments were under way or completed in 20 States and Hawaii at the close of the fiscal year. Field work was in progress in three States. The studies were Statewide in scope and were designed to yield information on motor-vehicle travel with respect to rural and urban ownership of vehicles, proportion of travel in rural and urban areas, and principal road systems used, together with pertinent characteristics of travel including purposes of travel and the frequency and length of trips. Such information is of considerable significance in the planning of highway programs.

Information available from analysis of data from five States in which the analyses were well advanced showed that travel on the highways is predominantly short-distance travel. In these five States, 60 percent of the passenger-car trips were less than 5 miles one-way length, and 79 percent were less than 10 miles. Only 1 percent of the trips were 100 miles or longer. However, only one-fourth of the passenger-car vehicle-milage consisted of the trips of less than 10 miles and 22 percent of the vehicle-milage resulted from the 1 percent of trips of 100 miles or longer.

Rural travel and road usage

The field work of the "after" study of rural-road usage in Charlotte County, Va., to determine the effects on highway travel of the establishment of a manu-

facturing industry in an area previously entirely agricultural in character, was completed and analysis begun. This "after" study was made near the end of the year, 5 years after the "before" study and about 4½ years after the industrial plant began operations.

The preliminary findings indicated no tendency for the workers to move nearer the plant. Two-thirds of the workers lived more than 5 miles distance from the plant and one-third lived more than 10 miles away. The percentage of workers living 10 miles or more from the plant almost doubled in the nearly 5 years of plant operation. Widespread ownership of automobiles, even in the relatively low income groups, and usable highways made it possible for workers to live some distance from their place of employment, where family or economic reasons influence the choice of dwelling location.

Traffic studies in cities

Ten years ago the first urban origin-and-destination traffic study by the home-interview method was completed in Tulsa, Okla. Since then similar studies have been undertaken in more than 100 metropolitan areas. In the past year a resurvey of the Tulsa metropolitan area was initiated for the purpose of bringing the original travel data up to date and providing highway administrators with current facts upon which to appraise present highway needs. A comparison of the data collected in the two studies will emphasize changes that have taken place in urban highway transportation during the past decade.

Urban highway planning

Studies were completed of employees' place of residence and mode of travel to work as affected by the decentralization of government employment centers in the Washington, D. C., area. Results show that residences of those employed in the central area are distributed throughout the city and metropolitan area in the same proportion as general population distribution. However, as agencies are relocated at increased distances from a central point, a larger number of employees have residences in the area of the new office location, with a secondary group having residence in the area of greatest population density near the central business district. When place of employment is removed approximately 8 to 10 miles from the central business district, most of the employees live in the vicinity of employment or in the semirural area beyond. As the distance from the central business district increases, there is a corresponding increase in the proportion of the work trips made by automobile.

Residential areas ranging from high to low population density, high to low income, and from single-family to multi-family dwellings were studied. It is apparent from these studies that the number of trips per dwelling, especially the number of automobile trips, varies somewhat in proportion to the economic status. Studies of travel to shopping centers indicate the possibility of delineating market areas and of predicting the amount of travel to such centers by a formula based on travel distance and retail floor space of the shopping center.

Analyses were made of destinations of shopping trips to local commercial centers and to the central business district by residents of eight radial sectors of the Washington metropolitan area. The attraction of the central business district department stores to shoppers is shown by the fact that approximately 70 percent of all shopping trips to the central business district of Washington, other than walking, had destinations in the five subzones occupied by department stores; also, that 54 percent of all such trips were made by residents of one quadrant of the metropolitan area where 44 percent of the area's population lives.

These and similar analyses of the various component data produced by the home-interview type of traffic survey, developed by the Bureau, indicate the

increasing value of such studies to the city planning and marketing fields and general business enterprises, in considering highway problems.

Toll road studies

The Bureau continued its studies of the traffic using toll roads in order to establish a sound basis for estimating the volume and kind of traffic likely to be attracted to a proposed toll road and that which may be expected to be generated as a result of its construction.

An analysis of the data collected in a study in the area of the eastern extension of the Pennsylvania Turnpike showed that a larger percentage of vacation trips was diverted to the turnpike than of trips for any other purpose.

It was determined that the generated traffic is significantly higher than is usually estimated for toll roads. On the basis of traffic diverted from an adjacent road or, at most, two nearby roads, the generated traffic has been found to be equal to as much as three-fourths of the diverted traffic. A part of this additional traffic is probably traffic diverted from roads at a distance from the toll highway.

Nationwide highway finance study

An important phase of the nationwide study required by section 13 of the Federal-aid Highway Act of 1954 concerns the design standards adopted as criteria for identifying deficient sections of highways and estimating the cost of overcoming these deficiencies. The design standards prepared as a basis for the study reflect liberal application of research findings on traffic operations, including a number of recent studies which have not had previous impact on geometric design policy.

Of particular value in the definition of standards is the distinction, often difficult to draw, between design conditions that are tolerable and those that are applicable and desirable for new construction. It is in this area where an intimate knowledge of traffic performance under specific circumstances can be especially effective in working toward a practical determination of highway needs.

Effect of highway design on accidents

A unique opportunity to study the effect of highway design on accidents arose in 1947 with the completion of a new road, on new location, replacing the old U. S. 40 between Frederick and Hagerstown, Md. The old road continues in use. Both are two-lane roads, cross the same two mountain ridges, and have about the same total rise and fall, but some of their design characteristics are very different.

The old road is typical of our older mountain highways, with steep grades, sharp curves, narrow shoulders, and generally poor sight distance. Forty-five percent of its length is marked for no passing.

The new road has excellent sight distance (only 12 percent marked for no passing), no curves sharper than 4 degrees, many long straight sections, and wide paved shoulders. The grades are long, steep, and usually on straightaways, but in most respects it is a typical modern highway.

Analysis has been completed of the 554 accidents investigated by the State police on rural portions of the two roads in the 6 years 1948–53. The accident rates for the two roads were practically identical, 1.8 per million vehicle-miles of travel on the old road and 1.9 on the new. Both were slightly below the statewide rate of 2.0 for rural highways in the same period.

There were important differences in the kinds of accidents which predominated on the two roads and in the places where they occurred. The curves on the old road were dangerous, with a rate of 3.5 accidents per million vehicle-miles as compared with 1.5 on the straightaways. On the new road the curves

were notably safe, with only 0.9 of an accident per million vehicle-miles, while the straightaways had a rate of 2.0. Rear-end collisions were much more common on the new road than on the old, happening principally on steep upgrades where fast-moving passenger cars suddenly came upon the slower commercial vehicles. These findings provide a better understanding of the importance of sight distance, curvature, and gradient in the frequency of accidents.

Driver performance

The results of a study of driver performance on vertical curves (at the tops of hills), briefly summarized in the 1953 annual report, have been supplemented by completion and publication of a companion study on horizontal curves. The research was conducted in cooperation with the New York State Department of Public Works and supplemented with data from similar work in Maryland, Illinois, Minnesota, and South Carolina.

A sight distance on horizontal curves of at least 400 feet appears necessary for reasonable perception, reaction, and braking time. Vehicle speeds are considerably lower on horizontal curves than on vertical curves with the same minimum sight distance. Speeds evidently are controlled more by the obvious danger of running off the road on a horizontal curve than by the possible hazard of an unseen object where sight distance is limited on vertical curves. Centrifugal force can actually be felt, while the sight-distance hazard can only be imagined.

Effect of shoulder use

A vehicle standing on the shoulder of a highway because of the driver's choice or mechanical failure tends to influence traffic behavior on the highway. Studies made in cooperation with the Oregon State Highway Department disclosed some facts on the extent of this influence. At various locations a passenger car, maintenance truck, or barricade was placed on the shoulder either at the pavement edge or 3 feet or 6 feet from the pavement edge. Observations of the effect were recorded on two-lane and four-lane divided highways.

During light to moderate traffic flow on the wider two-lane highways and on four-lane highways, vehicle speeds were affected little, if at all, by objects on the shoulder. However, on two-lane pavements 20 feet or less in width, speeds averaged approximately 3 miles per hour lower with vehicles or barricades on the shoulder. An object placed at the edge of an 8-foot lane of a two-lane highway caused vehicles to travel 3.3 feet farther from the pavement edge than when the object was not present.

Pentagon network studies

Traffic control devices are effective aids to traffic movement and safety only when they are adapted to the needs of the drivers and properly coordinated with highway design. Research studies were begun on the Pentagon network and a portion of the Shirley Highway near Washington with the purpose of developing a system of improved signs and markings, and recommendations for application where traffic volumes are large.

A special technique of observing and recording driving actions that are symptomatic of confusion, uncertainty, or inattention was used. Operational facts on the actions of local and out-of-State drivers, together with extensive accident analyses, revealed weaknesses in the current signs and markings, and a program of improvement, including use of overhead illuminated directional signs, was to be formulated. There was discernible erratic action by some out-of-State drivers approaching diverging points on the one-way roadway system. Where a driver unfamiliar with the route must bear to the left, the incidence of both accidents and erratic driving was especially high.

As new devices are installed, the effect on actions of drivers will be studied.

By this process, refined standards will be evolved for signs and markings on the heavily traveled expressways of the network and under similar conditions elsewhere.

Speed consistency and accidents

The speed below which 85 percent of the drivers are observed to be traveling is often regarded as a safe speed. From this it is sometimes inferred that 15 percent of all drivers are habitual speeders, and that enforcement and education measures should be directed chiefly to this comparatively small group.

How valid is this inference? To what extent is speeding done by habitual speeders, and to what extent is it the occasional behavior of most drivers? An attempt to answer these questions was made in cooperation with the New York State Department of Public Works. At a rural location used chiefly by commuters, speeds and license numbers were recorded during the commuting periods of 10 mornings and 12 afternoons. It was possible to measure the speed of variability of each individual driver and to relate this to the variation between the average speeds of different drivers.

Variability of individual drivers was found to be greater, on the average, than the variability between different drivers. It is nearer the truth to say that most drivers drive fast some of the time than to say that some drivers drive fast most of the time. Control of excessive speeds involves more than just a small group of drivers.

Additional information about the drivers was obtained from questionnaire postal cards sent to the owners of the vehicles. It was found that the faster average speeds were by the younger drivers, the newer cars, and the drivers with higher annual mileages. But none of these factors, or any combination of them, correlated very closely with the individual's average speed.

The study is being extended to include the accident histories of the drivers whose speeds were observed, in the hope of finding some relation between a driver's average speed and his likelihood of having accidents.

Brake research

The Bureau completed an extensive study of motor-vehicle brake performance. It had the assistance of an advisory committee composed of representatives of 19 organizations connected with highway transportation, 3 from Government agencies and 16 from manufacturing, operating, and other groups.

The study revealed the general levels of brake performance of the various types of vehicles in everyday traffic, the improvement in brakes since 1942, the further improvement of commercial vehicle brakes that can be made through maintenance procedures, and the effects of speed and axle loads on brake performance. In addition, comparisons were made of the merits and capabilities of various instruments used for measuring brake performance.

The final report was approved by the advisory committee and is being prepared for publication. It presents factual information on brake performance, discusses use of the findings in enforcement work and the practical limitations of existing brake testers, and suggests a practical stopping ability requirement.

The results of this research will assist materially in establishing highway design standards such that drivers will be able to see obstructions at a distance at least equal to stopping distance and in formulating practical regulatory measures for brake performance. The results will also help to promote safety on streets and highways by pointing out deficiencies in the brake performance of vehicles as they operate in everyday traffic.

Economics of motor-vehicle size and weight

In the problem of size and weight limitations for trucks, it is increasingly evident that economic factors are equal in importance to technical factors.

Highway facilities can be constructed, at an increased cost, to carry the gross weight of any practical motor vehicle or combination of vehicles. Vehicle manufacturers can build practical motor vehicles of gross weight capacities greater than the size and weight limitations of many States. . As the sizes and weights of vehicles are increased, trucking costs generally diminish, but the degree and extent of cost reduction is not well established for different levels of gross vehicle weight in a manner that permits comparison with the corresponding costs of providing highway facilities.

The overall cost of highway freight transportation is the sum of the costs of owning, maintaining, and operating trucking equipment, plus such costs of constructing and maintaining highway facilities as may properly be assigned to freight vehicles. Previous limited studies do not provide data adequate for a determination of optimum maximum size and weight specifications of commercial vehicles that will provide the most economical transportation costs for all kinds of freight shipped by highway.

Comprehensive data of the following types are needed in order to develop optimum maximum size and weight specifications for commercial motor vehicles: (1) Operating practices of various types of motor carriers for the handling of different commodities, (2) operating costs of various types and sizes of freight vehicles, (3) costs of providing highway facilities by increments of axle loads and frequency of traffic, and (4) relation of total tonnage of commodities hauled to shipping densities of the commodities, in order to judge which commodities should not be loaded so as to occupy all of the cargo space in highway freight vehicles of the maximum allowed dimensions.

A program of field studies of the four phases was developed in collaboration with the committee on economics of motor vehicle size and weight of the Highway Research Board. Collection of field data was begun.

Hydraulic Research

The movement of flood water has great significance for highway engineers and users. Last year about $750 million was spent on highway drainage structures. Culverts alone took some 15 percent of the highway construction dollar. Studies of floods of streams draining areas under 10,000 acres in different parts of the country have shown that the same rainfall may produce a flood ten times greater in one stream than in another because of differing soil, slope, and other characteristics of the region.

Fortunately, boundaries of regions established by the Soil Conservation Service for classification of erosion problems also serve to delineate areas which have similar flood-producing characteristics. Data from seven physiographic regions in the east and midwest were analyzed. Charts in preparation will make possible reliable estimates of size and frequency of peak flow of water from culvert-size drainage areas in these regions. The charts were to be released as rapidly as completed. The purpose was to enable the design of culverts of adequate size without waste.

Analyses of flood flow from drainage areas larger than 10,000 acres were completed and published for two extensive regions extending from southern New York to Tennessee. Data on rainfall intensity were compiled for that portion of the United States (excluding New England) east of a line through the western boundary of the Dakotas, as a preliminary step to correlation with peak rates of runoff. Flood frequency studies for two regions in Texas were in progress at Fort Worth.

Research at Stanford University for the Bureau showed that rainfall intensity in northern California is affected by a number of topographic variables including the elevation and location of station and height of mountain barrier. The

results of this study were to be compared with data on the flow of streams in the areas studied.

The hydraulic research of the Bureau, as in previous years, was conducted largely in cooperation with States and universities. Experimental work was in progress at the Universities of Iowa and Missouri and at Oregon State College.

The Iowa Institute of Hydraulic Research continued basic research on scour (erosion of stream bed) around bridge piers. The field installation for measuring scour on the Skunk River near Ames, Iowa, indicated a depth of scour agreeing quite well with the amount computed from laboratory tests.

Research on the flow of water through rectangular culverts was continued at Iowa City, with special emphasis on energy dissipators designed to reduce the erosive effect of water discharge at culvert outlets. Results from culvert operation verified those obtained at Oregon State College for standard culverts. Simple changes in the culvert entrance enabled an increase in the flow which could be carried by a culvert.

The Bureau sought to devise means of preventing the filling up of drainage pipe with sand and silt. The problem is particularly serious on expressways where storm water must be carried considerable distances through pipe laid on gentle grades. Useful information was to be presented in a final report on sediment transportation and trapping of sediment in pipelines, being prepared by the Iowa Institute of Hydraulic Research.

An investigation of the efficiency of various arrangements of pipes at storm-sewer manholes has been started at the University of Missouri in cooperation with the Missouri Highway Commission.

A report on the restrictive effect produced by typical fish-ladder installations in model culverts, prepared by Oregon State College as a cooperative project with the State Highway Department and the Bureau, was completed and awaited publication by the college.

The Bureau followed closely experimental research by the U. S. Geological Survey on flow of streams at highway bridges. The survey needed such data for estimating flood flow from measurements of the damming effect of bridge piers and approaches. The Bureau planned to adapt these data for use by highway engineers in determining the required bridge waterway dimensions.

Physical Research

The Bureau continued its program of research on important problems in road construction, but the physical research staff also found it necessary to do routine testing of materials for work supervised directly by the Bureau, conduct special training courses for junior engineers, and engage in the commitee work of technical organizations of national influence. Committee work is considered of particular importance since it is the means through which the experience and research of the Bureau are combined with those of other agencies in formulating specifications, standards, and test methods applied in many different kinds of construction on a national scale.

Soil studies

Cooperation with the State highway departments of Maine, New Jersey, and Rhode Island in the development and production of engineering soil maps and reports was continued. A similar project was initiated in Illinois. The completed soil maps and reports have already been of considerable value in highway location, location of gravel deposits, and planning detailed soil surveys, particularly in New Jersey where mapping of the State is nearing completion.

Soil testing in cooperation with the Department of Agriculture was continued. Samples for testing were received from 14 counties located in 7 States. The soil

test data, together with the agricultural soil map and description of map units, will be of considerable value in the location of engineering structures and should reduce the time and effort required for detailed soil surveys for engineering purposes.

Research studies in cooperation with Maryland and West Virginia for the evaluation of shale, burned shale, chert, and refuse from coal mines for use in base courses and roadway shoulders were continued. As a result of laboratory tests and field performance studies, tentative specifications for such materials were prepared. A similar study was initiated in Pennsylvania.

The use of moisture cells for the determination of seasonal variations of moisture in subgrade soils beneath experimental pavements in Ohio, Indiana, and Idaho, was continued. The moisture-cell data from the Indiana project were correlated with the actual moisture content of the soil adjacent to the cells.

One of the most perplexing problems in highway engineering has been what to do about soils that give poor support to pavements. The expansion of highway construction programs, caused by the great increase in traffic, has resulted in the depletion of deposits of soil-aggregate base course materials in many areas. Because of this shortage, serious consideration has been given to the use of less desirable soils for subgrades and base courses. As yet no economical and satisfactory method of converting a poor soil into a good one, for highway purposes, has been discovered. A fundamental part of this problem is to find out more about the clay particles which control soil plasticity, volume change, and strength—factors vital in the use of soil materials. To this end, the Bureau has studied the clay fractions of soil by X-ray diffraction, differential thermal analysis, and other techniques for identification and characterization of constituents. When the composition and properties of clays are better known, it should be possible to identify those minerals that are the trouble makers, and the search for correctives can be made more intelligently.

In a more direct approach to this problem, negotiations were begun with several chemical manufacturing companies for the initiation of a cooperative program of development and evaluation of chemicals to stabilize poor soils sufficiently to permit their use.

The cooperative studies with the Indiana and Ohio State highway departments to determine the effectiveness of subbases composed of granular material or soil-cement mixtures for the control of pumping of concrete pavement were continued. Observations of the behavior of the pavement slabs and moisture-cell readings of cells in the subgrade beneath the pavements were made on both experimental projects. Roughness measurements were made on the Indiana pavement and equipment was designed and assembled for the measurement of deflections and strains in the concrete slabs. A preliminary report was prepared on the Indiana project, describing the design and construction and the pavement performance to an age of 4 years.

Progress was made on theoretical and model studies to determine the strength in soil of anchors for suspension bridges.

Laboratory tests were performed on subgrade soil from the WASHO test road to determine the physical characteristics of the soil at various densities and moisture contents. Such information will be correlated with pavement performance.

To permit more efficient routine testing of soils, modifications of existing equipment and development of new equipment and testing procedures were made. The new equipment includes an electric oven, roll-type pulverizer, and electrically driven compactor. Reports were presented on rapid means of determining the liquid limit of soil and on the use of various dispersing agents for particle-size analysis.

Equipment for the sand equivalent test (a new test to determine the quality

of soils) was constructed and initial tests made to determine the adaptability of the test to field control of the gradation of soils and aggregates. Additional permeability tests were performed on soil-aggregating materials, using previously developed apparatus, and a report describing the test procedure, together with a resume of test results, was presented.

Bituminous materials and mixtures

A report on the laboratory investigation of the resistance to heat of antistripping additives for bituminous material was prepared. Additives are sometimes necessary to make bituminous material adhere to particles of sand, gravel, or stone and it is important that the additive not be injured by hot mixing. New materials, claimed to be heat resistant, were tested and found to be satisfactory. Some of the manufacturers of additives that have been considered satisfactory except for heat resistance have developed new materials claimed to be heat stable and it is anticipated that all manufacturers will follow their example as a result of the information developed by this laboratory investigation.

Preliminary studies were begun to develop a method for determining the amount and character of the active ingredients present in an asphalt treated with an antistripping agent. Such a determination is important from the consumer's point of view since the use of additives considerably increases the cost of the asphalt.

The study of rubber in bituminous mixtures for pavements was continued with the completion of one program of tests and the start of supplementary tests covering additional materials. Reports on laboratory studies of 14 rubber powders and 1 plasticized rubber, showing the effect of rubber on the properties of asphalt and asphaltic paving mixtures, have been completed. Two new rubber compounds, one prepared by the coprecipitation of synthetic rubber latex and barite, and the other a synthetic rubber, have been combined with the typical asphalts used with other rubbers and their effects determined. They will also be tested in laboratory-prepared paving mixtures.

Inspection of test roads containing rubber has been continued. A number of such test sections in the New England States were inspected during the year. At an age of 4 years there was no essential difference in behavior between the sections that contained rubber and those that did not.

A study was made of the quality of asphalts from new producing fields and those produced by a new refinery process involving the fluxing of propane deasphaltized residuals with viscous slow-curing road oils. Further work will be done as new materials come into the market.

Preliminary work has been completed in the development of a test method for the examination of emulsified cut-back asphalt to determine more definitely the volatility of the diluent and provide more satisfactory control and specification limits.

The study of methods of testing bituminous mixtures has been continued, with special attention to the development of a procedure for compacting specimens to reproduce as nearly as possible the physical properties developed in the pavement by good construction operations. Correlation between laboratory-prepared specimens and cores taken from field projects is necessary for the proper evaluation of the different methods currently used in the design and testing of bituminous mixtures. Study was made of the kneading-compaction and direct-compression methods of forming specimens. Other compaction methods will be studied.

The study of bituminous mixtures conducted in cooperation with the North Carolina State Highway and Public Works Commission was continued. Two inspections were made of the test sections built with different aggregates and designed to have greater stability than has previously been obtained. In addition, the cooperative test program to correlate results of tests by the two laboratories was actively continued.

Cement, aggregates, and concrete

Durability of concrete continued to be of paramount importance and various investigations were conducted with this as the subject of principal interest. Although periodic inspections of the specimens in the long-time study of the performance of cement in concrete have shown, as reported below, that a high cement content and low water content appear to be intimately associated with durability, other aspects of the problem of concrete have been investigated to provide the best concrete at the least cost.

Although the oldest specimens in the long-time study have been exposed to the weather for only 9 years, failure or incipient failure of some has developed to a sufficient extent to indicate definite trends. The variables in these concretes were the type and composition of the cements and the amount of cement and water in the mix. All specimens prepared with a high cement content and low water content were in good condition, irrespective of the chemical composition of the cement. Even at an age of only 3 years, one group of specimens made with a cement content of 4½ bags per cubic yard and a slump of 6 inches showed scaling, cracking, and softening of the mortar for many specimens, and some specimens showed severe distress. The type or chemical composition of the cement was found to have little influence and the best results were obtained with a rich, dry concrete.

Other investigations as to the durability of concrete involved the suitability of various proprietary compounds for the preparation of air-entrained concrete, the effect of vibration (in placing the concrete) on the air content, the use of fly ash to replace a portion of the cement, the effect of the quality of the aggregate, and the resistance of the concrete to ice-removing salts.

A report covering the results obtained with 26 proprietary air-entraining agents was published. Five agents which were not received in time for inclusion in this investigation were tested and reports sent to the producers.

To supplement very meager data, a study of the effect of surface vibration on the air content of paving concrete was made. Tests of fresh concrete showed that slabs placed by vibration contained only 86 percent of the air in similar concrete placed by hand methods. Further studies of the air content of the hardened concrete are in progress.

Long-time weathering tests of concrete at the Bureau of Public Roads laboratory.

Tests were made to determine the effect on the properties of concrete of replacing a portion of the cement with fly ash, and to study methods of testing fly ash for significant characteristics. A report of the findings was in preparation.

A study of the possibility of improving the quality of coarse aggregates was begun. Many aggregates fail to furnish concrete with high enough flexural strength to give good service under traffic. Tests were made with a local aggregate to determine whether the aggregate could be improved to furnish better concrete. The methods tried included the use of aggregate with a smaller maximum size, removal of particles of questionable quality, and removal of dirt or films on the surface of the particles by mechanical scrubbing. Further tests on other aggregates were programed and additional methods proposed, including redesign of the proportions for the concrete and the study of the compatability of the coarse aggregate with different sands. Should these methods prove of value, it is expected that the cost of concrete per year of service can be reduced.

Further work was done on methods of treating concrete to resist the action of calcium or sodium chloride used to remove ice. The principal factors studied were the relative resistance afforded by use of different commercial air-entraining admixtures and the effect of the substitution of fly ash for a portion of the portland cement in plain or in air-entrained concrete.

A chemical reaction between alkali in portland cement and soluble silica in aggregate may be injurious to concrete. Studies of this reaction were continued with emphasis on methods of conducting tests to insure uniform results. Migration of alkali from specimen to specimen appears to be possible and it may be necessary to revise the methods of storing the specimens. Further studies of methods of using test specimens of concrete instead of mortar were made.

Studies of the accelerated soundness test for aggregate, the skid resistance of pavements, and the characteristics of fine aggregate were continued. A proposed revision of the soundness test, involving major changes in the method and the interpretation of the test result, was presented to the American Society for Testing Materials, but no action was taken. Studies of another method of testing aggregates for soundness were planned. Work on skid resistance of pavements was confined to refinements of a proposed laboratory test, and to studies of a pendulum type of machine developed by the National Bureau of Standards for tests of flooring. The results of tests of methods for determining the angularity of fine aggregates were reported to the American Society for Testing Materials.

Structural design of rigid pavements

Reports prior to 1950 mentioned an experimental reinforced concrete pavement constructed in 1938 in Indiana for the purpose of developing information on the behavior of sections of various lengths in which different amounts and types of longitudinal steel were incorporated. This was an undertaking in cooperation with the Indiana State Highway Department with the primary objective of investigating the desirability of reducing the number of transverse joints in concrete pavements through the use of longitudinal steel reinforcement. The regularly scheduled measurements and observations were discontinued with the publication of a report on performance over a 10-year period. The results were of great interest and led several States to construct experimental pavements of similar design to extend the data to even longer sections. Because of the continued interest in this pavement the State and the Bureau made another complete examination of the pavement, this time after more than 15 years of service. Work was begun on a report of the findings.

Laboratory tests on the structural performance of doweled pavement joints under the action of heavy and repeated loadings were continued. Utilizing special testing machines designed for the purpose, joints in concrete slabs, in which dowel systems for transferring load across the joint have been incorporated

exactly like those in concrete pavements, were subjected to loads comparable to truck-wheel loads, repeated many thousands of times. By means of precise measurements of strain and deflection the relative effectiveness of different designs was determined under conditions that closely simulate those of service. A considerable amount of new and valuable data was obtained on this practical design problem. No comparable data exist. An initial report showing the effect of dowel length, dowel diameter, and joint width on structural performance was being prepared.

Earlier reports described a cooperative study of the effects of variation in spacing of transverse joints in concrete pavements on long-time structural performance. Nearly identical experimental pavements were constructed in California, Kentucky, Michigan, Minnesota, Missouri, and Oregon. Reports containing the observations during the first 10 years of service life have been prepared by all of the States but one and this report was expected. The Bureau has been an active participant in these studies from the beginning and began preparation of an analysis of the data contained in the several individual project reports, which will be published.

Structural design of nonrigid pavements

There is a widespread interest in improving methods for determining the thickness and other design features of nonrigid pavements. Through its own researches and through contacts maintained with State highway departments the Bureau has participated in this development and has assisted in the compilation and publication of a summary of the design procedures presently being used by State highway organizations.

The cooperative study of nonrigid pavement design which has been under way for some time at Hybla Valley, Va., was continued. The Highway Research Board, the Asphalt Institute, and the Bureau cooperated in this study. An initial draft of a comprehensive report of the plate-load tests was prepared.

The WASHO road test

The WASHO (Western Association of State Highway Officials) road test of nonrigid pavements under truck traffic, sponsored by 11 Western States and Alaska, and conducted in southern Idaho under the immediate direction of the Highway Research Board, was continued through the year. The Bureau participated in planning the project, supplied the instrumentation, and furnished personnel to assist in carrying out the schedule of measurements and observations. Bureau representatives were called upon from time to time in an advisory capacity and it is expected that assistance will be rendered in the analysis and interpretation of the data. A Bureau representative on this project devised a pavement deflection measuring device that has been of considerable assistance in obtaining essential deflection data.

Bridges

The structural damping investigation that has been mentioned in recent reports was brought to a conclusion with the publication of a final report under the title *Tests of Structural Damping.*

During the year the Bureau cooperated with Oregon in a comprehensive test of a three-span continuous plate-girder highway bridge under moving vehicular loads. The bridge crosses the South Umpqua River near Roseburg, Oreg. A special trailer containing an assembly of strain and deflection recording equipment was sent over the road to the test site from Washington, D. C. An extensive series of strain and deflection measurements was made as heavy vehicles of known length, weight, and other characteristics were driven over the bridge. Valuable data on the dynamic effects of such loadings on a modern highway

bridge were obtained. The tests were conducted by State and Bureau personnel and analysis of the data by the State was begun.

Roughness measurement

The equipment developed by the Bureau for indicating the relative roughness of road surfaces continued to attract the interest of State and other highway organizations. During the year several additional States built equipment according to plans furnished by the Bureau. Efforts to improve the equipment and to develop means for determining its characteristics were continued.

Geophysical methods for subsurface exploration

The Bureau pioneered in the application of geophysical methods of subsurface exploration to the problems of highway engineering. Over the past 20 years methods have been developed and improved, portable apparatus has been designed and built, and better methods for interpreting field data have been developed. The applicability of the methods to a wide variety of highway engineering problems has been investigated.

During the year studies of landslide conditions were made and experimental work was done to determine the usefulness and limitations of certain types of resistivity apparatus of light weight and low cost. Training of foreign engineers and engineers from State highway departments in the use of the equipment and the interpretation of field data was continued. Application of the methods by Bureau personnel to construction of National forest and park roads has resulted in considerable monetary savings as well as improved design in a number of cases.

Appendix

LIST OF TABLES

Table 1.—Summaries of programs approved and work completed in the fiscal year 1954, by class of highway and by fund

	PROGRAMS APPROVED [1]						WORK COMPLETED					
	Total cost	Federal funds	Miles	Railway-highway crossing improvements: Crossings eliminated	Railway-highway crossing improvements: Structures reconstructed	Railway-highway crossing improvements: Crossings protected	Total cost	Federal funds	Miles	Railway-highway crossing improvements: Crossings eliminated	Railway-highway crossing improvements: Structures reconstructed	Railway-highway crossing improvements: Crossings protected
BY CLASS OF HIGHWAY							**BY CLASS OF HIGHWAY**					
Primary-rural, Interstate	$155,595,203	$81,731,329	1,338.0	18	2	16	$130,766,531	$68,059,530	967.5	32		5
Primary-rural, all other	371,773,635	192,341,798	4,985.5	45	8	102	272,042,061	139,628,426	3,520.7	48	8	81
Secondary-rural	351,636,044	185,104,445	15,302.8	28	2	153	325,461,447	169,532,792	14,995.0	28	3	186
Urban, Interstate	164,824,507	78,786,677	161.6	25	2	1	113,792,288	56,886,128	129.0	29	3	9
Urban, all other	251,493,270	125,900,224	566.6	46	6	18	225,427,756	116,741,954	637.5	56	7	34
Subtotal	1,295,322,659	663,864,473	22,354.5	162	20	290	1,067,490,083	550,848,830	20,249.7	193	21	315
Not classified [2]	32,455,223	28,355,324	690.0				38,847,965	34,440,599	739.4			
Total	1,327,777,882	692,219,797	23,044.5	162	20	290	1,106,338,048	585,289,429	20,989.1	193	21	315
BY FUND							**BY FUND**					
Federal-aid:												
Primary	$544,307,376	$281,354,647	6,333.9	72	10	122	$457,765,902	$234,835,552	4,693.0	97	10	115
Secondary	341,482,246	176,292,678	14,996.2	27	2	153	323,662,237	164,558,196	14,565.0	23	3	185
Urban	340,531,441	166,480,691	325.4	54	7	14	256,651,068	129,993,874	268.7	60	8	9
Interstate	44,969,727	23,003,500	337.0	5	1	1	11,125,581	5,771,970	112.9	3		
Prewar Federal-aid:												
Primary							179,345	89,672				
Secondary							23,942	11,971				
Grade crossing	4,995	4,495					1,496,640	1,303,886	.5	3		1
Access roads, Act of 1950	24,026,874	16,728,462	362.0	4			15,101,839	13,423,505	609.6	7		5
Defense Highway Act							1,483,529	860,204				
Subtotal	1,295,322,659	663,864,473	22,354.5	162	20	290	1,067,490,083	550,848,830	20,249.7	193	21	315
National forest highway [3]	22,087,141	20,313,588	534.6				22,245,569	21,027,870	481.7			
Tongass National Forest, Alaska [3]	626,100	626,100					608,700	608,700	1.7			
National park and parkway [4]	5,078,000	5,078,000	116.8				8,891,468	8,891,468	39.1			
Public lands	20,000	20,000					901,961	890,399	19.6			
Emergency flood relief	4,643,982	2,317,636	38.6				6,200,267	3,022,162	197.3			
Subtotal	32,455,223	28,355,324	690.0				38,847,965	34,440,599	739.4			
Total	1,327,777,882	692,219,797	23,044.5	162	20	290	1,106,338,048	585,289,429	20,989.1	193	21	315

[1] Initial commitment of funds.
[2] Forest, park, public lands, and emergency flood-relief projects.
[3] Includes construction projects only.
[4] Construction supervised by Bureau of Public Roads.

Table 2.—Projects under construction or plans approved on June 30, 1954, by class of highway and by fund

	Total cost	Federal funds	Miles	Railway-highway crossing improvements		
				Crossings eliminated	Structures reconstructed	Crossings protected
By Class of Highway						
Primary-rural:						
Interstate	$235,578,582	$122,952,326	1,581.0	39	4	12
All other	443,788,378	228,336,991	5,620.7	55	15	52
Secondary-rural	429,974,010	224,470,926	14,427.2	32	10	142
Urban:						
Interstate	369,805,067	178,852,739	367.1	87	10	2
All other	465,195,903	231,324,301	823.9	118	11	33
Subtotal	1,944,341,940	985,937,283	22,819.9	331	50	241
Not classified [1]	52,988,915	47,479,295	899.0			
Total	1,997,330,855	1,033,416,578	23,718.9	331	50	241
By Fund						
Federal-aid:						
Primary	$754,303,524	$387,804,974	7,479.5	111	22	84
Secondary	417,025,652	213,238,696	14,014.6	33	10	139
Urban	681,781,770	331,590,905	483.3	172	17	15
Interstate	53,739,934	27,837,501	348.9	10	1	
Prewar Federal-aid grade crossing	1,276,024	759,275				
Access Roads, Act of 1950	32,431,367	22,750,568	493.6	5		3
Defense Highway Act	3,783,669	1,955,364				
Subtotal	1,944,341,940	985,937,283	22,819.9	331	50	241
National forest highway [2]	29,965,964	28,022,619	619.5			
Tongass National Forest, Alaska [2]	2,565,200	2,565,200	6.8			
National park and parkway [3]	12,272,094	12,272,094	235.4			
Public lands	1,622,107	1,374,931	14.0			
Emergency flood relief	6,563,550	3,244,451	23.3			
Subtotal	52,988,915	47,479,295	899.0			
Total	1,997,330,855	1,033,416,578	23,718.9	331	50	241

[1] Forest, park, public lands, and emergency flood-relief projects.
[2] Includes construction projects only.
[3] Construction supervised by Bureau of Public Roads.

Table 3.—Apportionment of Federal-aid highway funds authorized for the fiscal year ending June 30, 1955 (apportioned December 23, 1953, effective January 1, 1954)

State or Territory	Primary highway system ($247,500,000)	Secondary or feeder roads ($165,000,000)	Urban highways ($137,500,000)	Interstate system ($25,000,000)	Total ($575,000,000)
Alabama	$5, 254, 353	$4, 071, 630	$1, 767, 190	$536, 065	$11, 629, 238
Arizona	3, 682, 659	2, 508, 001	524, 664	374, 943	7, 090, 267
Arkansas	4, 099, 014	3, 280, 781	754, 576	417, 845	8, 552, 216
California	11, 302, 419	5, 819, 399	11, 990, 492	1, 156, 953	30, 269, 263
Colorado	4, 430, 632	2, 959, 462	1, 121, 056	451, 275	8, 962, 425
Connecticut	1, 596, 556	804, 375	2, 612, 362	163, 779	5, 177, 072
Delaware	1, 206, 563	804, 375	276, 636	121, 875	2, 409, 449
Florida	4, 000, 064	2, 614, 900	2, 418, 720	408, 607	9, 442, 291
Georgia	6, 093, 832	4, 654, 049	1, 965, 808	621, 611	13, 335, 300
Idaho	3, 035, 086	2, 134, 840	259, 599	308, 923	5, 738, 448
Illinois	9, 485, 889	5, 165, 722	9, 433, 309	970, 391	25, 055, 311
Indiana	5, 844, 963	4, 028, 914	3, 227, 030	596, 664	13, 697, 571
Iowa	5, 946, 365	4, 351, 647	1, 601, 372	605, 903	12, 505, 287
Kansas	5, 975, 744	4, 183, 753	1, 267, 798	608, 403	12, 035, 698
Kentucky	4, 538, 481	3, 767, 905	1, 400, 780	463, 271	10, 170, 437
Louisiana	3, 836, 826	2, 777, 082	1, 977, 289	391, 908	8, 983, 105
Maine	2, 065, 955	1, 478, 426	563, 746	210, 595	4, 318. 722
Maryland	2, 164, 618	1, 323, 108	2, 289, 281	221, 739	5, 998, 746
Massachusetts	3, 127, 509	1, 161, 437	5, 614, 329	321, 494	10, 224, 769
Michigan	7, 641, 646	4, 662, 919	6, 277, 985	781, 229	19, 363, 779
Minnesota	6, 385, 910	4, 508, 055	2, 196, 488	650, 982	13, 741, 435
Mississippi	4, 401, 911	3, 666, 740	746, 808	448, 780	9, 264, 239
Missouri	7, 177, 220	4, 856, 080	3, 321, 925	732, 034	16, 087, 259
Montana	4, 945, 242	3, 401, 828	317, 626	503, 085	9, 167, 781
Nebraska	4, 801, 122	3, 404, 250	791, 122	488, 697	9, 485, 200
Nevada	3, 179, 310	2, 124, 823	102, 729	323, 336	5, 730, 198
New Hampshire	1, 206, 563	804, 375	399, 467	121, 875	2, 532, 280
New Jersey	3, 183, 593	1, 071, 310	5, 904, 745	327, 310	10, 486, 958
New Mexico	4, 002, 794	2, 749, 864	442, 682	407, 405	7, 602, 745
New York	11, 573, 650	4, 637, 841	18, 029, 580	1, 187, 586	35, 428, 657
North Carolina	6, 101, 355	5, 211, 948	1, 733, 316	622, 886	13, 669, 505
North Dakota	3, 572, 139	2, 593, 772	228, 084	363, 355	6, 757, 350
Ohio	8, 586, 082	5, 222, 980	7, 805, 716	878, 337	22, 493, 115
Oklahoma	5, 269, 114	3, 772, 951	1, 473, 687	536, 936	11, 052, 688
Oregon	4, 209, 393	2, 941, 860	1, 081, 596	428, 962	8, 661, 811
Pennsylvania	9, 663, 980	5, 751, 129	10, 211, 618	989, 979	26, 616, 706
Rhode Island	1, 206, 563	804, 375	964, 266	121, 875	3, 097, 079
South Carolina	3, 315, 477	2, 745, 191	927, 881	338, 411	7, 326, 960
South Dakota	3, 845, 626	2, 746, 570	261, 991	391, 167	7, 245, 354
Tennessee	5, 335, 882	4, 158, 793	1, 950, 550	544, 484	11, 989, 709
Texas	15, 972, 097	10, 694, 852	6, 462, 029	1, 628, 769	34, 757, 747
Utah	2, 830, 795	1, 872, 691	571, 559	288, 296	5, 563, 341
Vermont	1, 206, 563	804, 375	210, 027	121, 875	2, 342, 840
Virginia	4, 676, 730	3, 634, 841	2, 103, 426	477, 631	10, 892, 628
Washington	4, 070, 327	2, 719, 183	2, 035, 293	415, 444	9, 240, 247
West Virginia	2, 685, 059	2, 337, 564	877, 871	274, 317	6, 174, 811
Wisconsin	5, 816, 900	4, 058, 553	2, 641, 382	593, 492	13, 110, 327
Wyoming	3, 070, 586	2, 080, 954	146, 664	312, 346	5, 610, 550
District of Columbia	1, 206, 563	804, 375	1, 165, 310	121, 875	3, 298, 123
Hawaii	1, 206, 563	804, 375	453, 586	----------	2, 464, 524
Puerto Rico	1, 278, 217	1, 335, 768	1, 159, 454	----------	3, 773, 439

Table 4.—Apportionment of Federal-aid highway funds authorized for the fiscal year ending June 30, 1956 (apportioned June 21, 1954, effective July 1, 1954)

State or Territory	Primary highway system ($315,000,000)	Secondary or feeder roads ($210,000,000)	Urban highways ($175,000,000)	Interstate system ($175,000,000)	Total ($875,000,000)
Alabama	$6,738,800	$5,221,937	$2,266,452	$3,536,466	$17,763,655
Arizona	4,723,075	3,216,555	672,891	1,967,160	10,579,681
Arkansas	5,257,058	4,207,659	967,757	2,500,144	12,932,618
California	14,495,550	7,463,481	15,378,016	9,770,990	47,108,037
Colorado	5,682,364	3,795,562	1,437,773	2,303,899	13,219,598
Connecticut	2,047,610	1,031,625	3,350,400	1,656,627	8,086,262
Delaware	1,547,437	1,031,625	354,790	1,074,610	4,008,462
Florida	5,130,153	3,353,655	3,102,050	2,930,809	14,516,667
Georgia	7,815,446	5,968,900	2,521,183	4,043,968	20,349,497
Idaho	3,892,551	2,737,969	332,940	1,734,315	8,697,775
Illinois	12,165,819	6,625,129	12,098,383	8,105,625	38,994,956
Indiana	7,496,268	5,167,153	4,138,722	4,219,185	21,021,328
Iowa	7,626,317	5,581,064	2,053,788	3,545,901	18,807,070
Kansas	7,663,996	5,365,736	1,625,973	3,169,963	17,825,668
Kentucky	5,820,681	4,832,404	1,796,525	3,216,870	15,666,480
Louisiana	4,920,796	3,561,657	2,535,907	2,824,725	13,843,085
Maine	2,649,624	1,896,107	723,013	1,387,518	6,656,262
Maryland	2,776,160	1,696,909	2,936,043	2,041,509	9,450,621
Massachusetts	4,011,085	1,489,563	7,200,476	3,655,217	16,356,341
Michigan	9,800,544	5,980,275	8,051,625	6,180,407	30,012,851
Minnesota	8,190,042	5,781,659	2,817,034	3,899,163	20,687,898
Mississippi	5,645,528	4,702,659	957,795	2,754,064	14,060,046
Missouri	9,204,910	6,228,008	4,260,427	4,707,609	24,400,954
Montana	6,342,359	4,362,904	407,361	2,419,110	13,531,734
Nebraska	6,157,523	4,366,021	1,014,628	2,436,110	13,974,282
Nevada	4,077,521	2,725,122	131,752	1,785,146	8,719,541
New Hampshire	1,547,437	1,031,625	512,324	1,074,610	4,165,996
New Jersey	4,083,014	1,373,973	7,572,939	3,753,573	16,783,499
New Mexico	5,133,654	3,526,748	567,747	2,081,652	11,309,801
New York	14,843,409	5,948,112	23,123,251	12,160,327	56,075,099
North Carolina	7,825,095	6,684,414	2,223,008	4,380,315	21,112,832
North Dakota	4,581,331	3,326,558	292,522	1,926,290	10,126,701
Ohio	11,011,801	6,698,563	10,010,967	7,369,446	35,090,777
Oklahoma	6,757,731	4,838,876	1,890,029	3,094,245	16,580,881
Oregon	5,398,620	3,772,987	1,387,166	2,330,696	12,889,469
Pennsylvania	12,394,224	7,375,924	13,096,579	9,134,669	42,001,396
Rhode Island	1,547,437	1,031,625	1,236,688	1,074,610	4,890,360
South Carolina	4,252,157	3,520,756	1,190,023	2,331,532	11,294,468
South Dakota	4,932,082	3,522,524	336,008	2,024,381	10,814,995
Tennessee	6,843,362	5,333,724	2,501,615	3,689,779	18,368,480
Texas	20,484,493	13,716,335	8,287,665	9,889,608	52,378,101
Utah	3,630,545	2,401,759	733,035	1,661,565	8,426,904
Vermont	1,547,437	1,031,625	269,364	1,074,610	3,923,036
Virginia	5,997,988	4,661,747	2,697,681	3,468,488	16,825,904
Washington	5,220,265	3,487,400	2,610,298	2,744,023	14,061,986
West Virginia	3,443,635	2,997,967	1,125,885	2,045,557	9,613,044
Wisconsin	7,460,276	5,205,165	3,387,619	3,939,418	19,992,478
Wyoming	3,938,080	2,668,860	188,100	1,746,386	8,541,426
District of Columbia	1,547,437	1,031,625	1,494,531	1,074,610	5,148,203
Hawaii	1,547,437	1,031,625	581,732		3,160,794
Puerto Rico	1,639,336	1,713,145	1,487,020		4,839,501

Table 5.—Projects financed with Federal-aid funds programed [1] during the fiscal year ended June 30, 1954, by State

State or Territory	Primary			Secondary			Urban			Interstate			Total		
	Total cost	Federal funds	Miles	Total cost	Federal funds	Miles	Total cost	Federal funds	Miles	Total cost	Federal funds	Miles	Total cost	Federal funds	Miles
Alabama	$13,752,904	$7,188,963	131.4	$10,880,940	$4,985,795	527.6	$4,185,500	$2,509,530	16.9				$28,819,344	$14,684,288	675.9
Arizona	4,084,163	2,940,467	71.8	4,146,958	2,945,505	115.0	1,379,061	865,508	7.2	$531,958	$367,388	8.9	10,142,140	7,118,868	202.9
Arkansas	14,154,468	7,439,529	276.4	11,075,686	5,534,085	566.0	738,848	369,424	4.9	12,534	6,267		25,981,536	13,349,305	847.3
California	23,011,752	11,358,429	68.2	16,711,505	8,636,862	264.1	33,344,336	13,232,921	21.7	3,232,011	1,156,953	16.9	76,299,604	34,385,165	370.9
Colorado	2,524,915	1,388,185	16.2	1,397,865	795,949	51.8	1,030,026	562,908	.3	412,088	232,529	3.2	5,364,894	2,979,571	71.5
Connecticut	1,127,896	563,948	2.7	2,307,461	1,201,916	4.9	4,512,759	2,025,903	5.6	4,912	2,456		7,953,028	3,794,223	13.2
Delaware	4,094,951	2,036,903	21.0	1,967,732	984,649	15.3	1,354,971	1,040,947	.1	242,944	121,250	.1	7,660,598	4,183,749	36.5
Florida	11,164,706	5,645,918	136.5	6,909,737	3,551,528	214.0	2,860,172	1,641,350	9.6	962,258	481,129	12.0	21,896,873	11,319,925	372.1
Georgia	10,898,024	5,460,216	135.5	2,038,284	1,042,542	87.9	2,738,146	1,369,073	8.9	2,444,704	1,222,352	20.7	18,119,158	9,094,183	253.0
Idaho	7,212,617	4,540,812	58.8	5,278,806	3,371,010	183.0	13,800	7,767		1,053,905	617,472	5.5	13,559,128	8,537,061	247.3
Illinois	22,524,926	11,609,752	160.9	12,186,948	6,073,564	424.4	16,344,339	9,055,051	4.2	1,828,291	970,391	11.8	52,884,504	27,708,758	601.3
Indiana	24,262,848	12,159,224	146.7	6,206,495	2,980,343	59.1	10,201,415	5,159,254	15.7	17,898	8,949		40,688,656	20,307,770	221.5
Iowa	14,972,660	7,832,489	282.2	11,299,860	5,666,309	811.9	2,121,981	1,371,991	7.3	1,299,475	649,729	24.7	29,693,976	15,520,518	1,126.1
Kansas	9,311,880	4,696,096	278.7	10,294,219	5,176,221	1,185.9	2,864,760	1,437,680	7.8	1,158,686	579,343	13.4	23,629,545	11,889,340	1,485.8
Kentucky	10,142,055	5,071,935	69.8	6,801,586	3,501,893	135.5	1,853,600	927,800	4.9	750,000	375,000	7.0	19,547,241	9,876,628	217.2
Louisiana	9,905,044	4,952,522	61.2	5,882,372	2,929,566	90.6	8,119,700	3,000,000	2.6	427,096	213,548	3.6	24,334,212	11,095,636	158.0
Maine	150,000	75,000	1.7	2,514,682	1,259,526	27.8	672,456	336,228	2.3	445,702	210,101	2.3	3,782,840	1,880,855	34.1
Maryland	7,762,612	4,047,806	28.1	3,039,244	1,686,270	108.9	5,089,958	2,665,339	5.2	443,478	221,739	.2	16,335,292	8,621,154	142.4
Massachusetts	14,599,008	6,906,852	18.0	2,396,874	1,197,589	14.8	15,420,060	7,664,405	7.9				32,415,942	15,768,846	40.7
Michigan	15,337,600	7,668,800	132.1	10,265,236	5,146,614	520.3	23,415,016	11,508,283	9.2	2,189,436	1,090,718	11.4	51,207,288	25,414,415	673.0
Minnesota	14,970,206	7,850,794	306.5	10,109,309	5,086,635	1,165.0	5,995,674	2,961,823	26.0	811,524	359,576	10.5	31,886,713	16,258,828	1,508.0
Mississippi	7,357,377	3,830,645	172.8	6,267,252	3,011,286	330.6	792,404	486,702	5.2	724,391	362,196	9.2	15,141,424	7,690,829	517.8
Missouri	15,903,002	8,248,630	162.4	9,396,078	4,708,584	865.3	8,757,557	4,531,178	7.3	1,481,107	740,553	10.8	35,537,744	18,228,945	1,045.8
Montana	8,979,810	5,811,915	281.7	10,427,906	6,109,882	409.8	1,347,654	843,872	3.0	1,306,538	744,006	8.2	22,061,908	13,509,675	702.7
Nebraska	14,284,914	7,183,312	353.2	8,269,855	4,138,300	507.6	2,110,504	1,055,252	3.9	700,000	350,000	12.5	25,365,273	12,726,864	877.2
Nevada	4,508,891	3,818,003	135.8	2,291,772	1,915,764	118.6	1,843	1,540		5,804	4,850		6,808,310	5,740,157	254.4
New Hampshire	5,308,254	2,597,933	29.9	1,445,060	721,630	13.5	1,390,767	690,682	3.1	3,656	1,828		8,147,737	4,012,073	46.5
New Jersey	287,700	143,850	.8	500,010	250,005	4.3	17,905,265	6,462,840	11.2	430,000	215,000	1.4	19,122,975	7,071,695	17.7
New Mexico	7,304,900	4,563,013	134.5	5,584,808	3,382,302	238.6	260,531	164,265	2.4	9,692	6,111		13,159,931	8,115,691	375.5
New York	36,932,240	18,465,634	220.8	15,338,658	7,075,555	98.0	58,366,460	30,016,336	30.6	689,115	671,300		111,326,473	56,228,825	349.4
North Carolina	18,574,649	8,754,087	258.8	12,105,273	6,018,544	321.6	4,085,708	1,985,499	7.7	2,492,326	1,240,413	24.8	37,257,956	17,998,543	612.9
North Dakota	6,547,984	3,273,992	355.1	5,643,663	2,831,162	837.1				903,570	451,785	16.3	13,095,217	6,556,939	1,208.5

Ohio	23,286,969	10,085,582	62.1	8,062,846	3,809,210	89.0	24,504,352	10,959,757	16.1	26,350	13,175	-------	55,880,517	24,867,724	167.2
Oklahoma	17,335,168	9,131,405	167.4	8,489,136	4,443,366	343.1	4,080,000	2,315,176	10.7	2,601,592	1,055,440	7.9	31,905,896	16,945,387	529.1
Oregon	4,961,559	3,011,500	70.2	5,186,082	3,047,827	178.4	2,724,901	1,597,223	.5	692,885	428,434	9.0	13,565,427	8,084,984	258.1
Pennsylvania	21,174,058	10,437,029	48.3	14,339,410	7,088,936	70.4	32,114,548	16,057,324	8.9	1,979,958	989,979	4.2	69,607,974	34,573,268	131.8
Rhode Island	2,752,206	1,376,103	9.5	1,196,596	598,173	14.0	3,778,746	1,889,373	.4	486,250	243,125	.1	8,213,798	4,106,774	24.0
South Carolina	8,006,428	4,353,571	67.3	8,103,607	4,001,460	574.8	433,691	291,273	2.4	6,719	5,039	-------	16,550,445	8,651,343	644.5
South Dakota	7,893,468	4,426,942	254.4	4,443,057	2,606,873	362.3	45,458	25,447	.5	660,455	370,647	15.0	13,042,438	7,429,909	632.2
Tennessee	8,936,950	4,283,425	108.8	6,817,169	3,396,472	432.8	2,664,208	1,276,104	1.2	1,979,270	870,635	21.0	20,397,597	9,826,636	563.8
Texas	34,963,433	17,573,500	520.2	27,661,434	13,942,975	1,467.7	11,485,075	6,268,750	10.0	4,051,200	2,262,400	11.2	78,161,142	40,047,625	2,009.1
Utah	4,118,495	3,153,955	47.9	2,547,942	1,909,832	107.8	653,688	490,057	1.5	388,297	289,664	5.6	7,708,422	5,843,508	162.8
Vermont	1,625,968	820,874	15.8	1,648,294	823,895	27.8	760,392	369,737	2.8	257,656	128,828	1.9	4,292,310	2,143,334	48.3
Virginia	7,486,648	3,728,062	56.0	9,696,409	5,037,404	297.5	2,618,235	1,141,005	3.5	718,075	357,650	3.9	20,519,367	10,264,121	360.9
Washington	10,135,574	5,390,395	124.0	5,618,167	2,883,111	213.4	5,796,865	3,029,729	7.0	1,273,929	517,117	6.2	22,824,535	11,820,352	350.6
West Virginia	8,005,231	4,017,385	56.2	1,288,241	659,970	10.8	1,894,336	947,168	2.2	508,228	254,114	.4	11,696,036	5,878,637	69.6
Wisconsin	13,293,775	6,586,546	117.1	9,304,149	4,647,612	319.6	6,992,240	3,494,385	14.5	2,370,920	1,185,460	7.1	31,961,084	15,914,003	458.3
Wyoming	4,925,704	3,194,320	93.4	3,391,025	2,196,290	159.0	433,435	280,441	.5	552,844	356,861	8.1	9,303,008	6,027,912	261.0
District of Columbia	475,000	237,500	-------	1,468,253	730,700	1.6	-------	-------	-------	-------	-------	-------	1,943,253	968,200	1.6
Hawaii	1,750,805	862,047	3.1	558,749	270,525	2.2	-------	-------	-------	-------	-------	-------	2,309,554	1,132,572	5.3
Puerto Rico	1,224,981	558,852	2.0	679,546	280,662	5.2	276,000	96,391	-------	-------	-------	-------	2,180,527	935,905	7.2
Total	544,307,376	281,354,647	6,333.9	341,482,246	176,292,678	14,996.2	340,531,441	166,480,691	325.4	44,969,727	23,003,500	337.0	1,271,290,790	647,131,516	21,992.5

[1] Initial commitment of funds.

Table 6.—Projects involving Federal funds awarded to contract [1] during the fiscal year ended June 30, 1954, by program and by State

State or Territory	Total cost	Total Federal funds	Federal-aid funds				Other [3]	Miles
			Primary [2]	Secondary	Urban	Interstate		
Alabama	$38,406,373	$19,379,508	$13,164,187	$4,132.663	$1,558,328	$524,330		645.1
Arizona	9,186,323	6,464,045	3,132,420	2,562,681	349,780	361,764	$57,400	152.6
Arkansas	22,683,306	11,317,124	6,154,609	4,467,064	285,847	408,104	1,500	692.9
California	60,719,508	29,847,242	9,370,784	5,203,386	12,129,067	1,832,471	1,311,534	325.9
Colorado	11,742,488	6,491,264	3,121,793	2,342,724	356,269	197,044	473,434	269.4
Connecticut	3,420,536	1,746,709	300,279	734,088	584,880	127,462		3.2
Delaware	5,152,127	2,907,134	1,589,053	582,241	734,022	1,818		34.3
Florida	19,633,891	10,414.663	4,335,586	3,417,657	2,635,686	5,982	19,752	364.6
Georgia	26,098,591	12,906,053	5,306,208	4,473,579	1,946,307	863,028	316,931	531.7
Idaho	17,417,621	11,275,455	5,723,804	4,035,587	3,874	308,736	1,203,454	381.4
Illinois	59,080,406	30,446,117	15,108,051	3,173,944	10,702,052	1,394,070	68,000	460.4
Indiana	20,660,811	10,332,409	2,935,485	4,395,109	2,399,000	587,715	15,100	152.4
Iowa	29,550,115	16,034,433	6,906,651	4,845,681	3,549,787	717,314	15,000	1,118.5
Kansas	25,310,147	12,787,987	5,683,406	4,820,056	1,164,218	755,075	365,232	1,451.6
Kentucky	21,899,051	11,131,823	5,728,741	4,195,770	950,015		257,297	305.6
Louisiana	18,505,905	8,187,294	2,842,174	2,585,353	2,373,737	386,030		144.0
Maine	7,202,161	3,578,079	1,861,867	1,099,953	378,322	210,101	27,836	70.5
Maryland	10,245,076	5,311,774	2,771,208	2,002,790	252,382	220,394	65,000	132.6
Massachusetts	28,404,113	13,637,142	5,922,971	635,725	7,078,446			33.3
Michigan	31,957,002	16,373,350	6,460,042	4,970,995	4,165,563	776,750		606.1
Minnesota	31,193,578	16,305,667	7,641,488	5,112,109	2,820,786	731,284		1,504.9
Mississippi	18,198,798	8,945,033	3,876,908	4,237,599	450,250	380,276		643.0
Missouri	32,869,838	16,927,309	7,889,930	4,046,558	3,683,766	1,301,455	5,600	837.6
Montana	15,893,364	10,084,553	5,967,969	3,888,095	115,323	6,259	106,907	579.0
Nebraska	18,766,284	9,620,560	6,173,625	2,858,982	547,953	40,000		617.8
Nevada	7,872,450	6,547,098	3,989,581	1,914,663	1,533	641,321		236.1
New Hampshire	5,496,303	2,664,739	1,206,170	554,477	904,092			30.3
New Jersey	24,223,622	9,464,729	1,572,850	461,788	7,430,091			23.5
New Mexico	12,275,592	7,585,623	3,777,842	3,406,085	341,527	6,112	54,057	396.0
New York	131,072,787	63,503,094	18,457,098	9,322,201	33,720,616	1,661,347	341,832	469.9
North Carolina	31,065,443	14,655,996	6,714,072	5,355,019	1,829,466	613,543	143,890	560.5
North Dakota	12,133,026	6,068,094	3,047,358	2,641,975	14,266	360,000	4,495	1,271.3

Ohio	63,056,499	30,903,784	5,300,026	5,326,406	8,681,764	1,684,260	9,911,328	233.2
Oklahoma	18,957,132	10,173,433	4,864,158	3,053,893	1,484,024	526,558	244,800	335.4
Oregon	11,150,770	6,722,009	3,441,360	2,386,932	436,000	428,417	29,300	304.8
Pennsylvania	79,598,703	38,718,538	12,821,537	8,664,723	15,290,254	1,942,024	----------	198.5
Rhode Island	2,263,030	1,131,315	459,720	671,595	----------	----------	----------	18.6
South Carolina	11,273,373	5,794,529	2,225,356	3,531,682	37,491	----------	----------	598.5
South Dakota	10,901,508	6,167,970	3,141,358	2,300,856	228,226	383,530	114,000	634.7
Tennessee	22,374,817	11,332,327	4,373,825	4,747,194	1,387,353	650,865	173,090	729.4
Texas	73,596,483	38,939,140	17,417,200	12,948,690	4,872,700	2,247,400	1,453,150	1,954.5
Utah	6,495,958	5,147,636	2,169,734	1,493,942	504,507	4,314	975,139	261.4
Vermont	5,027,829	2,564,460	1,381,926	1,050,582	3,134	128,818	----------	59.2
Virginia	22,375,883	10,614,285	4,063,620	2,786,749	2,575,277	586,939	691,700	279.1
Washington	19,840,810	10,680,005	5,988,306	2,607,044	637,232	517,108	930,315	399.9
West Virginia	6,690,410	3,337,653	1,991,965	564,905	507,100	273,683	----------	47.8
Wisconsin	25,447,754	12,717,113	5,285,680	5,066,436	2,093,299	215,223	56,475	514.4
Wyoming	7,299,122	4,595,820	2,138,460	2,129,579	228,947	98,834	----------	225.5
District of Columbia	4,863,322	2,228,498	24,705	874,253	1,329,540	----------	----------	2.7
Hawaii	3,936,404	1,895,855	827,800	636,750	431,305	----------	----------	9.7
Puerto Rico	7,555,782	3,216,939	1,325,800	1,081,667	809,472	----------	----------	24.5
Total	1,211,042,225	619,823,403	257,976,746	170,400,475	146,994,876	25,107,758	19,343,548	21,877.8

[1] Includes force-account projects placed under construction during the fiscal year.
[2] Funds available for either rural or urban portions of the Federal-aid primary highway system.
[3] Includes prewar Federal-aid grade-crossing and 1950 access funds.

Table 7.—Status of Federal-aid projects [1] as of June 30, 1954, and projects completed during the fiscal year

State or Territory	Programed,[2] plans not approved			Plans approved, not under construction			Under construction			Completed during fiscal year		
	Total cost	Federal funds	Miles	Total cost	Federal funds	Miles	Total cost	Federal funds	Miles	Total cost	Federal funds	Miles
Alabama	$9,554,000	$4,923,120	310.0	$12,136,544	$6,268,392	216.9	$43,977,590	$21,900,171	477.2	$27,608,129	$14,302,278	677.4
Arizona	5,450,459	3,861,199	133.5	1,420,885	1,058,296	33.5	6,871,811	4,909,017	176.6	9,244,057	6,282,284	208.2
Arkansas	10,295,060	5,970,200	412.2	5,753,938	2,830,770	171.4	18,563,559	9,251,173	411.3	16,500,398	8,368,900	510.5
California	19,191,867	8,779,859	164.6	26,412,948	11,979,741	77.8	99,209,006	49,615,172	291.3	66,003,585	32,226,526	347.9
Colorado	4,342,935	2,418,197	39.8	408,348	224,188	1.6	19,461,769	10,556,057	223.2	11,834,545	6,974,777	352.5
Connecticut	2,652,301	1,326,150	7.9	4,600,165	2,122,068	6.1	5,090,278	2,553,848	12.6	11,686,706	5,762,254	26.2
Delaware	2,530,494	1,289,747	9.8	2,993,914	1,840,611	8.1	5,550,729	2,762,781	34.3	4,940,716	2,506,803	23.9
Florida	24,173,264	12,247,332	389.4	5,428,269	2,741,702	62.2	20,863,271	11,016,440	332.4	11,968,673	6,133,910	232.9
Georgia	10,133,568	5,211,104	196.0	7,520,173	3,944,278	146.3	38,373,146	18,287,415	552.4	26,423,500	14,210,279	558.5
Idaho	4,661,836	3,012,004	99.4	6,902,421	4,397,371	110.5	16,998,974	11,001,693	346.4	10,152,627	6,281,315	234.2
Illinois	34,464,645	18,471,822	345.7	10,279,246	5,194,154	121.7	77,293,819	40,731,356	485.7	53,234,111	26,582,233	604.4
Indiana	44,194,497	23,105,599	184.9	20,087,493	10,209,696	101.3	22,664,684	11,764,904	143.6	24,453,672	12,989,778	221.3
Iowa	11,172,251	6,150,705	395.4	8,963,597	4,807,306	380.2	27,470,711	14,798,328	849.6	15,891,699	7,876,773	882.3
Kansas	10,312,424	5,200,290	804.1	6,622,240	3,324,841	495.8	19,197,860	9,677,927	720.0	23,055,143	11,550,680	1,390.9
Kentucky	10,074,849	5,392,278	102.9	7,497,855	3,752,247	94.0	24,085,541	12,606,452	276.2	18,148,870	9,329,921	330.8
Louisiana	15,335,314	7,672,537	117.2	15,900,500	6,890,400	92.3	24,326,909	11,755,528	99.1	14,431,319	7,191,267	143.5
Maine	5,454,894	2,804,367	45.4	509,300	254,995	5.8	13,476,708	6,862,692	97.8	10,754,288	6,122,276	74.2
Maryland	12,976,060	6,739,430	81.6	5,027,438	2,790,523	61.5	9,363,225	4,784,188	43.8	8,557,588	4,680,499	91.2
Massachusetts	12,285,081	6,132,540	22.1	1,684,838	987,569	.3	57,142,229	26,856,214	42.8	13,578,478	6,743,144	30.6
Michigan	40,021,758	20,064,779	499.9	16,060,032	8,033,632	355.8	40,384,624	19,198,603	271.3	45,625,484	20,340,127	483.4
Minnesota	10,374,162	5,373,131	758.7	12,831,856	6,668,244	928.2	25,658,593	13,349,184	614.4	19,010,566	10,163,069	1,282.6
Mississippi	11,278,280	5,721,339	353.8	6,229,450	3,198,355	224.8	22,433,445	11,289,468	601.7	16,928,770	8,373,597	681.9
Missouri	17,669,749	9,110,755	861.4	8,696,979	4,620,967	319.4	57,152,322	28,298,795	581.1	31,242,454	16,446,610	724.8
Montana	15,803,598	9,552,877	349.9	5,241,310	3,237,912	191.9	22,258,109	13,645,067	452.8	11,037,963	6,705,064	380.8
Nebraska	22,796,810	11,891,605	895.9	5,218,838	2,823,100	83.4	17,787,490	9,498,942	511.1	12,550,584	6,381,758	378.9
Nevada	2,547,851	2,185,091	81.6	781,532	653,122	44.0	8,884,058	7,376,944	236.0	6,035,800	4,350,012	251.1
New Hampshire	4,375,800	2,187,900	26.8	1,635,994	812,141	6.3	7,174,263	3,647,423	38.9	4,451,737	2,204,271	35.8
New Jersey	4,233,000	2,116,500	51.7	1,976,052	948,850	5.5	23,022,679	8,855,882	15.7	33,613,704	16,099,424	46.8
New Mexico	5,263,845	3,328,634	129.0	2,484,108	1,574,845	42.4	10,008,902	6,232,603	253.1	9,802,945	6,197,021	333.1
New York	80,518,719	42,011,278	121.3	31,834,433	16,369,765	77.4	189,858,661	90,562,498	491.9	72,586,152	33,285,465	341.8
North Carolina	23,363,394	11,650,987	441.2	6,559,744	3,116,652	140.1	38,892,822	18,219,626	469.4	23,054,804	11,224,277	677.9
North Dakota	4,677,383	2,352,452	769.7	6,439,706	3,219,853	497.0	10,276,204	5,142,526	708.8	13,033,631	6,624,918	1,382.5

Ohio	25,881,876	13,077,254	105.3	19,419,053	8,953,025	40.3	105,221,723	51,098,742	214.5	50,016,667	26,435,643	159.7
Oklahoma	21,115,553	11,404,788	321.2	6,234,292	3,275,219	149.8	17,216,954	9,261,809	236.4	16,020,774	8,431,416	307.3
Oregon	3,408,822	1,983,400	23.3	2,034,337	1,228,324	90.8	15,771,752	9,550,577	258.8	12,339,977	7,269,543	300.1
Pennsylvania	23,254,672	11,602,336	16.9	36,126,508	17,888,429	56.9	95,817,353	46,819,938	214.4	58,065,807	28,812,774	196.7
Rhode Island	8,118,028	4,059,014	27.4	994,481	495,806	8.9	7,854,222	3,924,568	36.5	14,112,187	7,437,707	11.0
South Carolina	8,791,635	4,701,326	178.7	3,801,350	1,992,837	141.9	16,353,052	8,309,005	525.5	15,104,942	7,897,477	451.8
South Dakota	12,626,874	7,162,856	653.6	1,852,883	1,156,619	117.7	8,873,059	5,052,358	480.9	12,353,286	7,373,398	652.6
Tennessee	14,437,902	7,172,151	372.8	7,431,279	3,723,695	201.3	37,084,582	16,997,794	496.8	21,283,623	10,396,655	485.2
Texas	10,740,900	5,444,950	88.9	16,056,915	7,971,425	446.3	69,187,404	37,567,650	1,127.4	66,004,722	36,572,040	1,738.7
Utah	5,259,973	4,056,457	78.7	3,357,515	2,508,957	97.3	10,137,442	7,939,191	207.8	9,877,086	7,253,234	354.6
Vermont	2,902,100	1,458,650	33.7	1,129,641	554,362	7.7	9,037,635	4,561,229	65.7	5,542,592	2,725,415	53.8
Virginia	14,635,445	7,107,830	249.7	6,317,870	3,142,483	129.7	30,435,744	14,744,081	184.9	27,677,950	13,895,679	375.1
Washington	13,207,002	7,015,790	127.7	7,248,035	3,627,416	169.3	20,391,454	11,246,826	193.0	10,513,129	5,532,809	245.9
West Virginia	10,006,040	5,054,745	56.5	1,975,850	999,905	3.1	16,242,851	8,094,293	47.5	13,435,124	6,739,846	162.0
Wisconsin	17,987,248	9,471,174	176.3	8,809,864	4,386,026	193.1	27,900,396	13,808,471	361.4	34,448,542	17,641,621	580.2
Wyoming	5,637,713	3,669,378	108.5	1,028,507	666,632	20.0	9,653,561	6,089,677	250.3	6,624,292	4,363,866	185.2
Alaska							64,000	64,000	6.5			
District of Columbia	6,793,000	3,156,500	2.9	996,402	497,950	2.3	10,568,966	5,080,998	1.4	6,105,064	2,710,070	4.0
Hawaii	931,570	465,785	2.0	634,259	308,712	2.2	11,990,232	5,671,656	15.5	3,521,288	1,704,803	16.7
Puerto Rico	6,588,000	3,124,100	38.5	5,239,159	2,182,397	9.2	13,937,212	6,588,698	40.9	6,910,333	3,143.324	26.3
Total	704,504,501	369,444,292	11,865.4	386,828,346	196,456,805	6,991.3	1,557,513,594	789,480,478	15,828.6	1,067,490,083	550,848,830	20,249.7

[1] Includes projects financed from Federal-aid primary, secondary, urban, and interstate, prewar Federal-aid primary, secondary, and grade-crossing, Defense Highway Act, and 1950 access funds.

[2] Initial commitment of funds.

Table 8.—Improvements on the Federal-aid primary system in rural areas financed with Federal-aid funds: [1] Status of projects as of June 30, 1954, and projects completed during the fiscal year

State or Territory	Programed,[2] plans not approved			Plans approved, not under construction			Under construction			Completed during fiscal year		
	Total cost	Federal funds	Miles	Total cost	Federal funds	Miles	Total cost	Federal funds	Miles	Total cost	Federal funds	Miles
Alabama	$1,811,900	$948,410	30.5	$6,394,634	$3,352,417	68.3	$26,853,800	$13,484,246	208.9	$9,521,086	$5,040,043	69.8
Arizona	1,753,819	1,233,424	32.0	1,108,007	835,974	17.1	3,325,300	2,342,630	46.9	5,206,337	3,399,902	60.4
Arkansas	5,050,432	2,968,176	97.4	2,473,520	1,178,749	31.1	9,663,872	4,811,855	188.9	9,746,195	5,001,297	185.5
California	7,370,000	2,467,613	9.0	4,688,164	2,571,658	13.9	29,316,400	14,760,361	100.0	19,731,611	9,335,409	42.0
Colorado	1,310,000	739,724	4.5	118,677	66,459		9,029,076	5,020,118	89.4	5,681,895	3,329,448	124.6
Connecticut	1,132,808	566,404	2.7	303,884	204,797	.2	2,235,115	1,112,848	9.9	6,972,887	3,445,436	17.0
Delaware	1,416,196	708,098	1.0	253,374	128,807	5.2	4,747,717	2,363,064	30.1	2,355,274	1,170,700	10.5
Florida	14,570,258	7,351,429	203.6	2,123,029	1,066,314	21.8	6,742,320	3,396,290	128.5	3,772,782	1,873,013	48.7
Georgia	6,450,448	3,311,744	87.2	927,046	463,527	25.8	13,283,084	6,635,008	111.2	11,681,656	6,123,361	118.7
Idaho	2,226,234	1,432,677	23.7	4,313,449	2,672,436	32.7	7,645,327	4,959,935	99.9	5,074,016	3,238,141	67.5
Illinois	3,354,921	2,035,360	25.0	1,865,585	973,500	14.8	27,899,719	14,257,901	188.9	18,920,061	9,468,653	152.3
Indiana	19,142,048	9,609,524	78.2	10,660,675	5,330,338	55.5	8,263,854	4,132,027	51.2	9,456,160	4,717,934	36.9
Iowa	3,589,724	2,047,042	36.4	2,928,796	1,749,672	61.8	13,211,159	6,768,294	297.1	4,993,226	2,504,606	96.9
Kansas	2,536,948	1,285,674	78.4	2,731,929	1,379,523	84.9	9,646,736	4,830,373	246.8	10,015,852	4,844,849	198.5
Kentucky	4,640,288	2,395,096	30.6	2,131,454	1,065,727	25.0	10,911,024	5,505,261	100.2	6,375,910	3,372,867	62.1
Louisiana	8,319,376	4,159,688	46.1	1,775,200	887,600	21.9	5,535,331	2,672,038	33.9	8,746,199	4,337,830	68.2
Maine	1,209,000	584,000	8.6	218,000	109,000	2.1	4,166,214	2,076,397	30.7	3,328,802	1,776,967	16.4
Maryland	5,605,590	2,802,795	23.6	476,000	238,000	3.9	5,449,764	2,724,577	17.8	3,319,845	1,631,490	6.0
Massachusetts	2,079,763	1,029,881	1.2	412,074	206,037		8,126,858	3,796,050	14.2	4,952,137	2,464,457	9.8
Michigan	14,808,336	7,404,168	91.0	7,211,992	3,605,996	88.3	12,199,552	6,095,776	117.4	12,648,366	6,190,105	106.5
Minnesota	3,503,471	1,946,886	62.3	4,030,196	2,171,773	97.7	10,484,379	5,522,866	200.6	7,075,801	3,537,017	149.1
Mississippi	6,411,290	3,371,844	130.7	2,237,550	1,121,835	61.8	10,123,373	5,281,713	149.0	6,770,043	3,413,466	136.5
Missouri	3,852,367	2,039,984	30.1	3,138,859	1,833,888	22.8	21,425,898	10,381,849	166.8	16,379,376	8,314,557	111.7
Montana	7,762,144	4,740,733	122.3	2,904,328	1,932,085	109.1	12,981,519	8,268,965	200.1	4,131,814	2,386,253	109.2
Nebraska	13,343,700	6,810,850	315.7	1,031,962	532,031	15.2	10,100,489	5,066,244	239.3	5,144,957	2,582,070	134.2
Nevada	1,892,869	1,637,064	47.2	674,298	563,507	37.2	6,723,836	5,571,504	123.6	3,630,068	2,438,523	143.1
New Hampshire	3,500,000	1,750,000	21.8	79,498	39,749		2,574,794	1,214,138	20.2	790,748	390,277	3.8
New Jersey	430,000	215,000	1.4	131,310	52,524		420,824	186,836	.9	16,710,499	7,810,983	24.2
New Mexico	2,358,394	1,490,453	22.2	1,243,354	784,744	10.9	5,865,044	3,661,965	115.2	5,229,769	3,321,967	127.8
New York	26,625,782	14,074,354	65.8	7,394,419	4,032,662	23.2	39,937,408	18,694,557	261.9	17,725,816	8,461,262	163.8
North Carolina	10,388,786	5,192,723	154.1	2,934,036	1,390,643	54.2	17,629,879	7,693,435	182.3	8,282,136	3,886,289	92.0
North Dakota	850,967	425,484	19.9	4,196,200	2,098,100	206.8	6,174,850	3,087,421	297.6	6,691,284	3,504,328	361.9

Ohio	8,124,272	3,952,328	19.1	3,282,459	1,649,699	8.2	27,371,609	13,064,212	50.8	17,001,542	8,377,757	42.9
Oklahoma	12,258,000	6,464,112	121.9	3,622,422	1,899,107	24.8	9,121,580	4,791,329	65.2	6,511,226	3,566,792	72.6
Oregon	95,878	57,000	----------	1,036,171	631,574	11.5	8,969,485	5,471,777	115.2	5,470,540	3,149,122	75.4
Pennsylvania	6,676,526	3,338,263	6.6	6,243,560	2,971,780	11.5	31,253,243	15,620,874	74.2	16,967,373	8,483,494	29.2
Rhode Island	3,058,456	1,529,228	9.6	65,220	32,610	----------	3,897,840	1,947,226	16.5	919,539	459,770	.1
South Carolina	5,348,147	2,878,710	52.3	919,800	471,900	5.4	3,368,097	1,708,727	27.9	6,613,072	3,509,977	55.8
South Dakota	7,545,882	4,257,502	207.2	461,719	258,469	23.0	5,223,979	2,963,986	245.9	6,638,986	4,016,476	219.6
Tennessee	4,446,000	2,223,000	68.2	3,163,140	1,581,570	52.8	14,943,886	6,746,393	152.2	11,485,613	5,583,721	111.0
Texas	3,914,800	1,961,800	49.3	4,526,307	2,210,550	113.2	27,349,150	14,081,500	326.3	19,647,644	10,554,300	332.8
Utah	2,751,577	2,134,230	32.7	1,373,190	1,024,399	17.4	5,727,476	4,401,917	50.3	4,786,151	3,451,200	62.1
Vermont	2,140,000	1,077,600	23.3	39,852	19,926	----------	5,117,644	2,606,170	23.3	2,610,054	1,287,472	15.6
Virginia	2,607,000	1,303,500	23.1	2,484,066	1,233,618	18.4	13,183,321	6,442,197	68.5	11,712,442	5,795,439	83.6
Washington	4,030,500	2,150,660	41.7	3,735,814	1,943,485	42.4	8,995,625	4,838,639	115.2	2,961,544	1,456,525	42.3
West Virginia	7,790,528	3,915,684	44.3	1,076,100	543,770	1.6	5,588,386	2,781,594	20.3	6,774,308	3,343,101	77.9
Wisconsin	6,835,522	3,442,701	43.7	4,466,085	2,203,974	41.3	11,286,363	5,737,889	86.7	17,287,748	8,885,615	167.5
Wyoming	3,786,280	2,462,015	64.6	406,500	261,698	6.3	5,563,281	3,457,480	77.2	2,077,577	1,346,084	36.4
Hawaii	----------	----------	----------	69,500	34,247	----------	2,772,938	1,365,999	5.3	1,552,692	749,368	5.1
Puerto Rico	2,253,500	1,080,673	13.7	2,801,495	1,390,227	7.8	4,053,643	1,882,191	9.5	727,933	358,243	2.7
Total	272,960,727	143,005,308	2,725.5	122,884,899	65,002,675	1,601.8	556,482,061	286,286,642	5,599.9	402,808,592	207,687,956	4,488.2

[1] Includes projects on rural portions of the Federal-aid primary highway system financed from Federal-aid primary and interstate, prewar Federal-aid primary and grade-crossing, Defense Highway Act, and 1950 access funds.

[2] Initial commitment of funds.

Table 9.—Improvements on secondary roads in rural areas finance d with Federal-aid funds: [1] Status of projects as of June 30, 1954, and projects completed during the fiscal year

State or Territory	Programed,[2] plans not approved			Plans approved, not under construction			Under construction			Completed during fiscal year		
	Total cost	Federal funds	Miles	Total cost	Federal funds	Miles	Total cost	Federal funds	Miles	Total cost	Federal funds	Miles
Alabama	$5,936,100	$2,680,110	272.8	$3,832,728	$1,836,104	140.7	$5,378,700	$2,606,730	222.0	$12,036,666	$5,688,751	573.4
Arizona	2,534,000	1,859,805	95.3	301,994	214,493	16.4	2,442,590	1,842,703	125.0	3,724,071	2,682,366	146.1
Arkansas	3,520,472	1,826,396	306.2	3,239,628	1,631,626	140.3	5,900,732	2,944,841	216.8	6,156,704	3,068,853	320.5
California	9,715,867	5,202,246	154.7	4,015,988	2,368,629	51.8	10,576,805	5,979,185	141.2	12,073,569	6,410,893	258.8
Colorado	1,049,322	578,129	29.8	247,557	134,145	1.6	4,051,505	2,167,751	132.1	6,045,902	3,583,641	227.3
Connecticut	1,064,130	532,065	3.2	38,885	19,050	.2	1,375,128	734,088	1.8	1,277,190	634,045	2.3
Delaware	1,050,000	527,100	8.8	762,120	381,060	2.8	355,612	176,489	3.8	1,913,498	1,001,730	11.8
Florida	5,842,446	3,012,423	179.1	1,049,702	531,219	33.8	5,365,606	2,741,132	173.1	4,423,363	2,366,281	170.2
Georgia	2,683,120	1,399,360	106.3	2,718,256	1,597,873	85.7	10,793,229	5,509,502	406.2	9,955,194	5,667,991	420.2
Idaho	2,429,370	1,575,434	75.7	2,219,135	1,493,935	77.1	7,141,694	4,716,330	237.0	4,961,920	2,970,308	166.0
Illinois	11,014,570	5,493,785	313.0	3,227,354	1,611,677	104.5	8,616,973	4,295,461	247.0	13,427,972	6,604,243	426.4
Indiana	9,800,458	4,903,306	87.7	4,269,352	2,081,148	40.0	9,232,051	4,587,890	81.0	7,069,821	3,268,708	161.0
Iowa	5,503,693	2,761,446	351.7	4,019,017	2,044,872	296.5	7,321,403	3,669,237	518.2	8,379,318	4,130,200	745.4
Kansas	5,953,638	2,998,097	719.8	3,890,311	1,945,318	410.9	6,719,041	3,373,604	458.5	9,594,219	4,862,413	1,163.1
Kentucky	2,358,032	1,321,418	66.0	3,501,343	1,753,991	60.6	7,431,390	3,816,507	163.1	7,420,978	3,769,541	249.5
Louisiana	4,553,690	2,281,725	68.8	2,240,540	1,120,270	42.1	6,536,876	3,268,407	58.4	4,125,278	2,073,916	72.4
Maine	3,728,982	1,961,911	35.2	44,710	32,993	.2	4,349,446	2,204,743	50.7	6,417,985	3,854,443	52.3
Maryland	2,611,792	1,432,296	53.8	1,578,379	910,773	53.3	3,845,135	2,025,448	26.0	2,643,872	1,336,087	82.1
Massachusetts	2,439,324	1,219,662	16.8	420,924	355,612	.3	1,345,135	667,092	8.0	2,350,788	1,150,898	12.0
Michigan	8,568,436	4,358,818	407.0	4,143,110	2,076,921	258.8	5,970,696	3,232,248	124.8	8,715,811	4,360,113	365.9
Minnesota	4,540,923	2,313,861	682.4	6,291,329	3,167,635	803.4	4,951,440	2,305,412	348.4	7,033,270	3,510,600	1,099.7
Mississippi	3,998,478	1,907,239	219.9	2,946,900	1,455,770	156.8	8,677,271	4,100,805	435.8	9,439,144	4,596,809	542.1
Missouri	10,059,036	5,049,198	826.5	3,418,996	1,715,087	293.3	6,224,939	3,116,242	388.8	8,042,034	4,023,393	598.3
Montana	6,955,744	4,148,428	224.4	1,807,597	974,151	81.5	8,543,992	4,958,316	237.2	6,296,766	3,775,482	271.2
Nebraska	9,099,010	4,884,105	577.5	1,285,561	666,645	56.8	7,267,961	4,226,778	271.8	4,680,984	2,434,938	233.7
Nevada	653,139	546,487	34.4	107,234	89,615	6.8	2,158,390	1,803,907	112.4	1,984,639	1,577,947	105.5
New Hampshire	650,000	325,000	4.8	305,230	152,540	2.3	1,354,120	675,810	14.4	2,518,336	1,252,996	26.1
New Jersey	2,823,000	1,411,500	49.0	362,473	177,220	4.5	366,521	175,005	2.6	996,186	497,171	4.7
New Mexico	2,644,920	1,673,916	104.4	1,150,628	732,904	31.1	2,540,737	1,552,632	130.6	4,001,677	2,512,666	197.6
New York	4,572,564	2,318,732	18.7	7,184,170	3,559,349	41.3	18,971,400	8,884,072	139.2	15,856,113	7,137,867	143.8
North Carolina	9,412,878	4,700,899	280.9	1,219,852	593,201	54.5	13,255,415	6,605,985	272.0	8,876,802	4,429,605	513.8
North Dakota	3,826,416	1,926,968	749.8	2,243,506	1,121,753	290.1	4,101,354	2,055,105	411.3	5,718,797	2,813,907	991.5

Ohio	7,374,748	3,653,498	78.2	2,728,975	1,360,420	20.9	30,253,608	15,584,596	130.9	10,012,547	5,257,561	103.9
Oklahoma	3,677,553	1,936,150	180.7	2,595,450	1,361,334	125.0	5,200,894	2,724,027	165.6	6,437,219	3,258,634	220.9
Oregon	1,370,000	771,400	23.0	971,166	580,527	79.3	3,567,290	2,123,800	132.6	5,827,538	3,511,281	222.9
Pennsylvania	2,117,022	1,033,511	7.3	4,956,962	2,453,606	32.4	15,205,564	7,601,082	109.1	13,835,306	6,747,461	139.6
Rhode Island	1,280,826	640,413	17.4	877,135	437,133	8.9	1,448,496	716,948	12.8	57,491	28,746	
South Carolina	2,605,027	1,329,770	124.0	1,406,320	669,410	124.3	6,736,483	3,290,142	487.5	5,777,831	2,807,022	390.9
South Dakota	5,080,992	2,905,354	446.4	1,277,164	834,333	93.9	2,844,449	1,636,880	229.5	5,106,917	3,016,063	430.2
Tennessee	7,091,902	3,499,151	303.2	2,278,461	1,147,286	145.5	8,855,814	4,177,678	340.3	6,163,937	3,086,398	349.7
Texas	1,455,100	732,150	35.7	5,510,883	2,792,025	308.5	17,688,198	9,206,950	736.5	20,096,112	10,062,740	1,332.1
Utah	1,664,364	1,252,009	43.3	1,496,789	1,120,857	78.3	3,298,965	2,664,574	155.8	3,939,464	2,956,652	285.3
Vermont	762,100	381,050	10.3	329,398	164,699	4.9	3,239,260	1,614,693	41.1	2,409,780	1,180,704	35.7
Virginia	8,107,439	4,253,827	219.6	3,179,684	1,581,805	110.0	4,058,843	2,166,472	99.6	10,329,311	5,408,661	280.0
Washington	3,937,502	2,110,230	82.2	1,960,959	1,028,116	118.6	3,685,569	2,304,574	64.0	4,042,528	2,138,523	199.6
West Virginia	1,239,176	650,893	9.8	899,750	456,135	1.6	3,164,065	1,572,999	24.9	4,651,781	2,392,181	80.6
Wisconsin	4,233,756	2,209,488	122.8	3,105,736	1,522,046	146.6	8,412,196	3,931,625	270.1	10,434,299	5,151,590	392.2
Wyoming	1,769,734	1,153,895	43.6	369,707	242,226	13.6	3,180,225	2,048,197	171.4	3,909,406	2,502,603	146.3
Alaska							64,000	64,000	6.5			
Hawaii	819,710	409,855	1.8	539,010	261,591	2.2	2,918,631	1,362,552	6.8	1,594,011	777,313	11.1
Puerto Rico	2,406,500	1,141,536	21.5				4,420,115	2,098,552	28.5	2,677,102	1,199,857	19.3
Total	208,587,001	109,196,045	8,895.2	108,568,058	56,561,128	5,054.5	321,405,952	167,909,798	9,372.7	325,461,447	169,532,792	14,995.0

[1] Includes projects on secondary roads in rural areas financed from Federal-aid secondary, prewar Federal-aid secondary, and grade-crossing, Defense Highway Act, and 1950 access funds.

[2] Initial commitment of funds.

Table 10.—Improvements in urban areas financed with Federal-aid funds: [1] Status of projects as of June 30, 1954, and projects completed during the fiscal year

State or Territory	Programed,[2] plans not approved			Plans approved, not under construction			Under construction			Completed during fiscal year		
	Total cost	Federal funds	Miles	Total cost	Federal funds	Miles	Total cost	Federal funds	Miles	Total cost	Federal funds	Miles
Alabama	$1,806,000	$1,294,600	6.7	$1,909,181	$1,079,870	7.7	$11,745,090	$5,809,195	46.4	$6,140,376	$3,573,484	34.2
Arizona	1,162,640	767,969	6.2	10,884	7,829		1,103,921	723,683	4.7	313,649	200,016	1.7
Arkansas	1,724,156	1,175,628	8.7	40,790	20,395		2,998,955	1,494,477	5.6	597,500	298,750	4.5
California	2,106,000	1,110,000	.8	17,708,796	7,039,454	12.1	59,315,800	28,875,626	50.0	34,198,405	16,480,224	47.1
Colorado	1,983,614	1,100,345	5.6	42,114	23,584		6,381,187	3,368,188	1.7	106,748	61,687	.6
Connecticut	455,363	227,681	2.0	4,257,396	1,898,221	5.6	1,480,035	706,913	.9	3,436,630	1,682,773	6.9
Delaware	64,298	54,549		1,978,420	1,330,744	.1	447,400	223,228		671,944	334,373	1.5
Florida	3,760,560	1,883,480	6.8	2,255,538	1,144,169	6.5	8,755,345	4,879,018	30.8	3,772,529	1,894,615	13.9
Georgia	1,000,000	500,000	2.4	3,874,871	1,882,878	34.8	14,290,853	6,142,905	35.0	4,786,651	2,418,928	19.7
Idaho	6,232	3,893		369,837	231,000	.7	2,211,953	1,325,427	9.5	116,691	72,866	.7
Illinois	20,095,154	10,942,677	7.7	5,186,308	2,608,977	2.4	40,777,127	22,177,994	49.8	20,886,077	10,509,337	25.7
Indiana	15,251,991	8,592,769	19.0	5,157,466	2,798,210	5.8	5,168,778	3,044,988	11.5	7,927,692	5,003,135	23.4
Iowa	2,078,834	1,342,217	7.3	2,015,783	1,012,762	22.0	6,938,149	4,360,796	34.2	2,519,155	1,241,967	40.0
Kansas	1,821,838	916,519	5.9				2,832,092	1,473,950	14.6	3,445,072	1,843,418	29.3
Kentucky	3,076,528	1,675,764	6.4	1,865,058	932,529	8.4	5,743,127	3,284,684	12.8	4,351,982	2,187,513	19.2
Louisiana	2,462,248	1,231,124	2.3	11,884,760	4,882,530	25.3	12,254,702	5,815,084	6.9	1,559,842	779,521	2.9
Maine	516,912	258,456	1.6	246,590	113,002	3.5	4,961,049	2,581,552	16.5	1,007,500	490,866	5.5
Maryland	4,758,678	2,504,339	4.2	2,973,058	1,641,750	4.2	68,326	34,163		2,593,872	1,712,922	3.0
Massachusetts	7,765,994	3,882,997	4.1	851,840	425,920		47,670,236	22,393,072	20.5	6,275,553	3,127,789	8.8
Michigan	16,644,986	8,301,793	1.9	4,704,930	2,350,715	8.8	22,214,376	9,870,579	29.0	24,261,306	9,789,909	11.0
Minnesota	2,329,768	1,112,384	14.0	2,510,331	1,328,836	27.1	10,222,774	5,520,906	65.4	4,901,495	3,115,453	33.8
Mississippi	868,512	442,256	3.2	1,045,000	620,750	6.2	3,632,801	1,906,950	16.9	719,583	363,322	3.3
Missouri	3,758,346	2,021,573	4.8	2,139,124	1,071,993	3.3	29,501,485	14,800,704	25.6	6,821,044	4,108,660	14.8
Montana	1,085,710	663,716	3.2	529,385	331,676	1.4	732,598	417,786	15.5	609,383	543,328	.4
Nebraska	354,100	196,650	2.7	2,901,315	1,624,424	11.4	419,041	205,921		2,724,642	1,364,750	10.9
Nevada	1,843	1,540					1,832	1,533		421,093	333,542	2.4
New Hampshire	225,800	112,900	.2	1,251,266	619,853	4.0	3,245,349	1,757,475	4.4	1,142,654	560,998	5.9
New Jersey	980,000	490,000	1.3	1,482,270	719,106	1.0	22,225,333	8,494,041	12.3	15,907,019	7,791,270	17.9
New Mexico	260,531	164,265	2.4	90,127	57,196	.5	1,603,121	1,018,006	7.3	571,499	362,389	7.7
New York	49,320,373	25,618,192	36.8	17,255,844	8,777,754	12.8	130,949,853	62,983,870	90.7	39,004,223	17,686,337	34.2
North Carolina	3,561,730	1,757,365	6.1	2,405,856	1,132,808	31.4	8,007,528	3,920,206	15.1	5,895,866	2,908,383	72.0
North Dakota										623,549	306,683	29.2

Ohio	10,382,856	5,471,428	8.0	13,407,619	5,942,906	11.2	47,596,506	22,449,934	32.8	23,092,578	12,800,325	12.8
Oklahoma	5,180,000	3,004,526	18.7	16,420	14,778		2,894,480	1,746,453	5.6	3,072,329	1,605,989	13.9
Oregon	1,942,944	1,155,000	.3	27,000	16,223		3,234,978	1,955,000	11.1	1,041,898	609,140	1.8
Pennsylvania	14,461,124	7,230,562	3.0	24,925,986	12,463,043	13.0	49,358,546	23,597,982	31.1	27,263,128	13,581,819	28.0
Rhode Island	3,778,746	1,889,373	.4	52,126	26,063		2,507,886	1,260,393	7.3	13,135,156	6,949,191	10.9
South Carolina	838,461	492,846	2.4	1,475,230	851,527	12.2	6,248,472	3,310,136	10.1	2,714,039	1,580,479	5.1
South Dakota				114,000	63,817	.7	804,631	451,492	5.4	607,382	340,859	2.8
Tennessee	2,900,000	1,450,000	1.3	1,989,678	994,839	3.1	13,284,882	6,073,723	4.3	3,634,071	1,726,536	24.6
Texas	5,371,000	2,751,000	3.9	6,019,725	2,968,850	24.6	24,150,056	14,279,200	64.7	26,260,966	15,955,000	73.8
Utah	844,032	670,218	2.7	487,536	363,701	1.7	1,111,001	872,699	1.7	1,151,471	845,382	7.3
Vermont				760,392	369,737	2.8	680,731	340,366	1.3	522,759	257,238	2.5
Virginia	3,921,006	1,550,503	7.0	654,120	327,060	1.4	13,193,580	6,135,412	16.8	5,636,197	2,691,579	11.6
Washington	5,239,000	2,754,900	3.8	1,551,262	655,815	8.3	7,710,260	4,103,612	13.8	3,509,057	1,937,761	4.0
West Virginia	976,336	488,168	2.4				7,490,400	3,739,700	2.4	2,009,036	1,004,564	3.5
Wisconsin	6,917,970	3,818,985	9.8	1,238,043	660,006	5.2	8,201,837	4,138,958	4.6	6,726,494	3,604,416	20.5
Wyoming	81,699	53,468	.3	252,300	162,708	.1	910,056	584,000	1.7	637,309	515,179	2.5
District of Columbia	6,793,000	3,156,500	2.9	996,401	497,950	2.3	10,568,966	5,080,998	1.4	6,105,064	2,710,070	4.0
Hawaii	111,860	55,930	.2	25,749	12,874		6,298,663	2,943,105	3.4	374,585	178,122	.5
Puerto Rico	1,928,000	901,891	3.3	2,437,664	792,170	1.4	5,463,454	2,607,955	2.9	3,505,298	1,585,225	4.3
Total	222,956,773	117,242,939	244.7	155,375,389	74,893,002	335.0	679,625,581	335,284,038	856.0	339,220,044	173,628,082	766.5

[1] Includes projects in urban areas financed from Federal-aid primary, secondary, urban, and interstate, prewar Federal-aid primary, secondary, and grade-crossing, Defense Highway Act, and 1950 access funds.

[2] Initial commitment of funds.

Table 11.—Interstate system improvements financed with Federal-aid funds: [1] Status of projects as of June 30, 1954, and projects completed during the fiscal year

State or Territory	Programed,[2] plans not approved			Plans approved, not under construction			Under construction			Completed during fiscal year		
	Total cost	Federal funds	Miles	Total cost	Federal funds	Miles	Total cost	Federal funds	Miles	Total cost	Federal funds	Miles
Alabama	$647,800	$327,020	9.4	$3,858,640	$2,056,770	34.5	$18,319,036	$9,177,319	100.1	$7,684,670	$3,878,365	30.1
Arizona	643,819	462,624	16.0	464,125	372,830	4.4	2,755,064	1,931,567	32.0	4,125,820	2,689,865	51.9
Arkansas	2,108,962	1,253,481	39.7	5,940	5,346		4,062,373	2,009,757	67.9	3,718,402	2,075,256	43.6
California	3,666,000	1,378,820	5.4	11,955,417	5,328,807	21.4	41,739,500	19,372,173	81.8	23,567,055	11,331,733	29.7
Colorado	3,053,614	1,704,253	7.8	12,088	6,769		10,595,148	5,694,428	46.4	1,413,953	791,095	32.9
Connecticut	381,905	190,952	2.0	4,257,396	1,898,221	5.6	3,068,440	1,503,107	10.1	7,715,023	3,804,661	19.1
Delaware	800,000	400,000	.5				4,080	1,818				
Florida	7,648,258	3,831,329	52.9	2,651,349	1,323,196	17.7	6,749,100	3,605,113	48.1	2,308,020	1,161,792	24.6
Georgia	2,002,648	1,060,924	18.5	1,925,153	900,639	8.1	18,758,967	8,383,972	84.0	6,551,894	3,275,947	40.6
Idaho	7,412	4,633		1,433,249	873,683	10.1	3,808,233	2,334,230	36.7	2,578,965	1,611,360	34.8
Illinois	15,111,110	7,535,855	5.9	4,702,585	2,321,500	8.9	44,665,535	23,604,298	115.5	19,555,711	9,817,096	41.0
Indiana	11,580,468	5,718,141	19.3	5,364,694	2,763,440	11.2	4,127,672	2,065,836	9.7	7,583,891	4,475,470	17.0
Iowa	18,082	9,041		264,352	132,175	4.9	1,622,231	767,869	23.9	421,695	205,428	4.2
Kansas	36,426	18,213					1,510,150	755,075	18.9	2,993,532	1,376,753	32.3
Kentucky	2,338,770	1,306,885	8.5				2,904,255	1,403,127	16.9	2,347,169	1,252,947	18.3
Louisiana	4,463,436	2,231,718	14.8	2,226,680	1,113,340	18.1	7,698,917	3,489,730	17.3	3,415,980	1,707,990	24.2
Maine							4,277,627	2,216,601	9.0	2,291,260	1,145,630	15.3
Maryland	2,031,652	1,015,826	12.7				4,557,120	2,278,305	12.3	4,541,601	2,664,108	2.7
Massachusetts	117,000	48,500					13,380,151	6,003,109	9.1	4,109,161	2,045,610	6.0
Michigan	10,740,836	5,400,718	23.5	5,779,622	2,888,061	14.5	20,675,700	9,108,491	21.5	26,665,572	11,057,344	36.0
Minnesota	2,413,886	1,213,193	43.3	1,249,542	847,013	24.2	4,066,922	1,980,441	48.8	1,882,815	927,504	26.0
Mississippi	1,548,538	774,269	18.3	1,220,700	708,600	4.9	7,025,633	3,850,816	68.9	2,757,877	1,411,226	40.8
Missouri	4,037,468	2,132,534	7.7	3,282,355	1,907,665	11.1	25,548,467	12,806,759	57.5	13,231,823	6,775,110	77.2
Montana	4,036,071	2,463,303	38.4	822,739	516,142	10.6	3,104,900	2,009,998	36.7	52,907	42,154	7.0
Nebraska	930,000	465,000	17.5				588,654	294,327	15.2	11,701	5,851	
Nevada	755,804	632,600	11.5				1,406,795	1,157,991	6.4	1,916,896	1,523,653	12.7
New Hampshire	520,000	260,000	3.3	7,292	3,646		776,322	540,715	1.4	381,908	187,979	.8
New Jersey	430,000	215,000	1.4	12,240	4,896		2,659,000	1,255,000	.8	9,775,536	4,741,547	18.8
New Mexico	1,859,692	1,175,690	19.1	366,889	231,324	1.9	4,949,973	3,126,795	64.4	3,067,459	1,944,769	69.8
New York	7,732,588	3,601,868	12.6	13,850,730	7,150,850	5.9	63,968,616	30,319,565	19.3	5,325,800	2,411,759	2.5
North Carolina	5,629,740	2,813,200	34.8	1,493,410	732,485	21.2	6,738,390	2,925,040	65.0	647,590	323,795	6.5
North Dakota	21,768	10,884		1,147,300	573,650	18.3	1,197,060	598,530	48.6	879,952	436,508	27.3

Ohio	5,926,350	2,963,175	.7	9,802,600	3,677,967	7.5	21,854,683	9,912,382	20.6	9,793,221	4,848,955	11.6
Oklahoma	5,016,000	2,647,851	28.6	998,782	526,558	.5	4,417,618	2,312,501	11.6	487,950	257,338	1.2
Oregon	691,345	409,000	.3	40,123	24,434		8,244,077	4,994,131	59.8	2,828,733	1,702,064	21.2
Pennsylvania	8,309,146	4,154,573	1.8	18,274,200	9,137,150	3.1	60,129,013	29,084,090	59.9	16,585,973	8,282,500	22.4
Rhode Island	6,707,292	3,353,646	10.0				1,990,634	995,317	5.6	3,308,206	1,654,103	1.5
South Carolina	967,719	550,539	7.0				955,000	477,500	.7	4,601,505	2,458,042	47.3
South Dakota	2,440,862	1,369,811	40.8							2,018,953	1,050,718	47.7
Tennessee	3,846,000	1,923,000	14.5	723,174	361,587	10.1	7,797,170	3,820,117	31.3	6,849,417	3,269,906	47.3
Texas	4,840,800	2,620,400	32.6	4,738,485	2,363,500	32.6	27,278,050	15,047,400	113.9	10,808,204	6,239,600	40.6
Utah	2,152,725	1,719,689	20.4				3,574,386	2,824,881	21.6	2,646,559	1,894,679	22.4
Vermont	104,000	52,000	.2	3,656	1,828		2,016,841	1,008,141	7.9	224,194	112,097	.6
Virginia	1,447,000	558,500	5.0	14,328	7,164		4,357,055	2,102,936	18.3	3,108,360	1,547,508	10.5
Washington	7,400	6,660		3,103,111	1,471,517	18.0	4,709,726	2,570,612	26.5	3,229,094	1,793,502	4.0
West Virginia	3,018,628	1,509,314	14.1	631,100	315,550	.5	6,356,270	3,172,635	4.1	2,716,900	1,358,450	5.8
Wisconsin	4,095,474	2,047,737	8.3				3,319,446	1,659,723		377,779	334,000	.8
Wyoming	2,064,185	1,333,009	40.2	275,700	177,798	.7	4,113,903	2,524,696	41.6	1,452,133	1,041,891	17.9
Total	148,948,679	76,875,378	669.3	106,959,746	52,726,101	330.5	498,423,903	249,078,964	1,617.6	244,558,819	124,945,658	1,096.5

[1] Includes projects financed from Federal-aid primary, secondary, urban, and interstate funds.
[2] Initial commitment of funds.

Table 12.—Federal funds paid by Bureau of Public Roads during fiscal year ended June 30, 1954, by program and by State

State or Territory	Federal-aid funds				Defense Highway funds	Total [2]
	Primary [1]	Secondary	Urban	Interstate		
Alabama	$8,074,609	$5,057,834	$1,544,252	$204,897	$213,709	$15,171,680
Arizona	2,954,015	2,363,763	809,718	319,729		6,447,225
Arkansas	3,320,867	3,178,727	458,109	372,839		7,330,542
California	11,636,509	5,045,479	10,548,623	515,656	609,734	28,356,001
Colorado	3,520,586	2,364,119	1,160,350	3,477	701,472	7,750,004
Connecticut	2,330,174	748,224	−224,769	1,251		2,910,591
Delaware	672,596	374,470	172,867			1,219,933
Florida	2,382,228	2,368,797	2,147,414		111,210	7,009,649
Georgia	5,308,183	3,520,450	1,360,087	125,634	901,086	11,238,674
Idaho	3,285,086	2,737,999	27,200	147,554	7,235	6,205,074
Illinois	7,937,193	7,282,199	10,364,294	989,578	112,746	26,686,010
Indiana	3,656,963	3,471,317	3,279,122	553,816	21,959	11,053,773
Iowa	4,336,112	3,696,800	977,024	238,022	55,094	9,303,052
Kansas	5,226,036	4,564,892	1,259,806	559,251	772,385	12,382,370
Kentucky	3,756,184	4,239,327	1,967,773		243,131	10,206,415
Louisiana	3,274,578	2,004.662	1,527,446	383,535	98,261	7,336,145
Maine	2,049,605	1,595,291	1,049,969	59,890	589,770	5,347,962
Maryland	1,524,976	1,647,872	785,039	144,400	35,386	4,137,673
Massachusetts	3,427,231	691,134	5,137,763			9,256,128
Michigan	6,471,620	3,638,667	3,533,344	63,742	206,386	13,913,759
Minnesota	5,326,916	3,771,196	2,478,450	413,231	14,730	12,004,523
Mississippi	4,684,017	5,473,004	623,278		12,309	10,792,608
Missouri	8,639,516	4,143,883	4,599,362	199,404		17,582,165
Montana	3,189,125	3,072,668	87,320		84,411	6,433,524
Nebraska	2,247,032	2,325,661	941,738		24,103	5,538,534
Nevada	2,522,072	1,954,336	57,698	299,818	−89,723	4,744,201
New Hampshire	420,505	1,011,330	891,587			2,323,422
New Jersey	3,321,538	542,447	7,760,130	321,542	10,606	11,956,263
New Mexico	4,225,249	2,617,451	570,437	313,605	284,014	8,010,756
New York	5,686,699	6,170,452	18,215,921		99,097	30,332,737
North Carolina	4,569,459	4,270,207	1,366,974		173,303	10,379,943
North Dakota	3,721,825	2,932,842	158,749	268,003	30,954	7,331,584
Ohio	10,212,964	5,405,583	10,811,507	529,656	4,804,498	31,768,313
Oklahoma	3,810,743	2,279,587	835,338		294,356	7,603,791
Oregon	4,956,758	3,309,878	1,086,937	323,475	79,687	9,756,735
Pennsylvania	10,064,750	7,665,144	9,223,634	966,894		27,920,422
Rhode Island	1,180,957	983,287	530,030		39,701	2,733,975
South Carolina	2,617,700	2,701,826	428,409	251,621	53,821	6,053,377
South Dakota	3,098,546	2,675,258	544,444	306,415	119,961	6,759,114
Tennessee	6,150,471	3,644,438	723,684		93,906	10,612,499
Texas	13,568,800	9,325,500	5,829,100	1,312,200	1,975,033	32,010,633
Utah	3,170,292	1,981,251	815,554	1,306	727,773	6,696,176
Vermont	1,136,884	1,065,541	428,664		9,440	2,648,113
Virginia	6,030,280	3,858,370	3,348,617	200,231	228,485	13,665,983
Washington	2,929,698	2,182,801	1,839,229	157,657	359,153	7,623,819
West Virginia	1,872,280	1,576,710	214,416			3,663,406
Wisconsin	9,566,913	5,056,159	3,048,176		58,944	17,858,093
Wyoming	2,512,380	2,311,187	125,581	210,808		5,159,956
Alaska					24,339	24,339
District of Columbia	292,851	1,270,485	681,639			2,244,975
Hawaii	2,113,439	1,114,822	436,562		101,522	3,766,345
Puerto Rico	778,426	933,700	671,811			2,383,937
Undistributed					174,542	174,542
Total	219,764,436	158,219,027	127,260,407	10,759,137	14,468,529	531,821,463

[1] Funds available for either urban or rural portions of the Federal-aid primary highway system.

[2] Included in the totals are the following payments of prewar Federal-aid grade-crossing funds:

Alabama	$76,379	Ohio	$4,105
Connecticut	55,711	Oklahoma	383,767
Georgia	23,234	South Dakota	14,490
Indiana	70,596	Vermont	7,584
Louisiana	47,663	Washington	155,281
Maine	3,437	Wisconsin	127,901
New York	160,568		
North Dakota	219,211	Total	1,349,927

Table 13.—Balances of Federal-aid funds available to States for projects not yet programed as of June 30, 1954

State or Territory	Primary [1]	Secondary	Urban	Interstate	Total
Alabama	$723,389	$1,818,143	$2,993,831	$544,049	$6,079,412
Arizona	1,304,767	447,421	267,205	7,555	2,026,948
Arkansas	1,172,959	1,360,005	839,793	411,578	3,784,335
California	--	1,364,610	67,771	--	1,432,381
Colorado	4,682,796	3,481,330	566,587	470,064	9,200,777
Connecticut	1,082,283	1,536,500	6,154,508	195,061	8,968,352
Delaware	461,284	982,710	--	121,875	1,565,869
Florida	1,069,484	128,926	2,643,839	320,300	4,162,549
Georgia	5,848,475	4,150,134	3,342,040	17,353	13,358,002
Idaho	552,983	403,052	920,586	187	1,876,808
Illinois	303,000	7,798,287	4,669,073	--	12,770,360
Indiana	1,331,020	5,124,167	748,302	--	7,203,489
Iowa	878,167	1,009,757	1,912,414	448,059	4,248,397
Kansas	1,977,274	3,616,839	760,615	29,060	6,383,788
Kentucky	1,805,690	2,433,074	1,083,237	480,914	5,802,915
Louisiana	1,235,883	562,379	2,057,608	--	3,855,870
Maine	2,352,265	385,820	1,011,337	210,595	3,960,017
Maryland	152,329	749,966	5,563,584	--	6,465,879
Massachusetts	347,458	908,249	441,126	640,426	2,337,259
Michigan	1,496,165	1,938,234	352,491	22,571	3,809,461
Minnesota	151,021	2,851,020	1,570,840	--	4,572,881
Mississippi	2,270,001	1,384,390	660,134	256,911	4,568,436
Missouri	1,367,207	6,472,512	2,085,093	135,671	10,060,483
Montana	2,404,954	2,406,492	62,340	263,389	5,137,175
Nebraska	3,481,824	3,725,931	1,172,774	622,328	9,002,857
Nevada	2,940,585	3,009,824	309,553	--	6,259,962
New Hampshire	943,507	968,115	41,005	239,479	2,192,106
New Jersey	3,599,227	1,921,212	4,558,049	112,310	10,190,798
New Mexico	940,073	546,579	518,880	446,280	2,451,812
New York	3,071,380	670,153	2,101,090	850	5,843,473
North Carolina	2,394,585	1,772,212	1,085,300	--	5,252,097
North Dakota	1,138,097	1,592,449	838,369	458	3,569,373
Ohio	1,587,003	5,278,380	442,232	--	7,307,615
Oklahoma	2,143,880	3,649,891	2,089,249	16,072	7,899,092
Oregon	1,436,061	978,322	206,406	924	2,621,713
Pennsylvania	2,371,814	439,197	1,086,723	--	3,897,734
Rhode Island	558,400	520,655	14,643	--	1,093,698
South Carolina	3,974,933	387,777	1,563,432	338,411	6,264,553
South Dakota	482,175	818,854	656,092	20,520	1,977,641
Tennessee	2,259,488	2,163,376	2,435,596	214,057	7,072,517
Texas	3,379,047	7,955,277	2,248,963	74,884	13,658,171
Utah	75,030	336,201	95,171	--	506,402
Vermont	894,807	149,458	164,020	59,479	1,267,764
Virginia	1,537,543	648,581	1,842,517	357,967	4,386,608
Washington	101,435	905,167	350,907	--	1,357,509
West Virginia	1,357,886	4,514,201	251,241	20,203	6,143,531
Wisconsin	307,035	2,486,730	891,458	--	3,685,223
Wyoming	391,793	60,239	41,889	49,661	543,582
District of Columbia	1,511,333	1,074,433	1,469,573	243,125	4,298,464
Hawaii	1,141,383	1,487,555	555,551	--	3,184,489
Puerto Rico	1,609,265	2,661,191	1,336,559	--	5,607,015
Total	80,600,443	104,032,977	69,141,596	7,392,626	261,167,642

[1] Funds available for either urban or rural portions of the Federal-aid primary highway system.

Table 14.—Mileage of designated Federal-aid highway systems, by State, as of June 30, 1954

State or Territory	Federal-aid primary highway system									Federal-aid secondary highway system
	National system of interstate highways [1]			Other			Total			
	Total	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban	
	Miles	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*	*Miles*
Alabama	904	790	114	4,291	4,002	289	5,195	4,792	403	12,202
Arizona	1,184	1,149	35	1,353	1,285	68	2,537	2,434	103	3,022
Arkansas	528	467	61	2,953	2,822	131	3,481	3,289	192	13,489
California	1,899	1,680	219	5,365	4,666	699	7,264	6,346	918	9,616
Colorado	661	628	33	3,384	3,303	81	4,045	3,931	114	3,736
Connecticut	267	158	109	826	643	183	1,093	801	292	1,118
Delaware	26	23	3	515	465	50	541	488	53	1,287
Florida	1,136	993	143	3,190	2,841	349	4,326	3,834	492	10,511
Georgia	1,104	996	108	6,299	6,067	232	7,403	7,063	340	12,647
Idaho	613	593	20	2,519	2,469	50	3,132	3,062	70	4,141
Illinois	1,548	1,283	265	8,798	7,964	834	10,346	9,247	1,099	9,143
Indiana	1,068	884	184	3,804	3,350	454	4,872	4,234	638	15,611
Iowa	697	632	65	9,032	8,670	362	9,729	9,302	427	32,420
Kansas	728	677	51	7,029	6,803	226	7,757	7,480	277	22,216
Kentucky	656	590	66	3,240	3,047	193	3,896	3,637	259	14,851
Louisiana	606	507	99	2,047	1,902	145	2,653	2,409	244	5,652
Maine	299	272	27	1,338	1,260	78	1,637	1,532	105	2,261
Maryland	270	204	66	1,739	1,493	246	2,009	1,697	312	5,646
Massachusetts	347	206	141	1,703	1,078	625	2,050	1,284	766	2,200
Michigan	985	849	136	5,552	5,173	379	6,537	6,022	515	19,993
Minnesota	856	750	106	6,570	6,095	475	7,426	6,845	581	17,306
Mississippi	684	608	76	3,915	3,810	105	4,599	4,418	181	9,164
Missouri	1,075	996	79	7,028	6,828	200	8,103	7,824	279	16,038
Montana	1,237	1,209	28	4,625	4,585	40	5,862	5,794	68	3,597
Nebraska	477	455	22	4,873	4,755	118	5,350	5,210	140	11,264
Nevada	540	529	11	1,658	1,637	21	2,198	2,166	32	2,186
New Hampshire	213	183	30	1,010	891	119	1,223	1,074	149	1,372
New Jersey	204	102	102	1,521	1,005	516	1,725	1,107	618	1,919

New Mexico	1,013	968	45	3,101	2,999	102	4,114	3,967	147	4,607
New York	998	740	258	9,558	7,986	1,572	10,556	8,726	1,830	19,330
North Carolina	714	627	87	6,139	5,843	296	6,853	6,470	383	21,878
North Dakota	517	496	21	2,833	2,798	35	3,350	3,294	56	11,090
Ohio	1,231	996	235	6,422	5,547	875	7,653	6,543	1,110	12,402
Oklahoma	809	747	62	6,572	6,381	191	7,381	7,128	253	10,936
Oregon	729	668	61	3,273	3,145	128	4,002	3,813	189	4,925
Pennsylvania	1,364	1,068	296	5,902	4,992	910	7,266	6,060	1,206	13,146
Rhode Island	47	21	26	424	220	204	471	241	230	359
South Carolina	749	694	55	3,928	3,726	202	4,677	4,420	257	11,294
South Dakota	520	503	17	3,669	3,585	84	4,189	4,088	101	12,209
Tennessee	1,038	958	80	4,316	4,108	208	5,354	5,066	288	9,292
Texas	2,770	2,487	283	13,259	12,538	721	16,029	15,025	1,004	24,942
Utah	716	659	57	1,554	1,474	80	2,270	2,133	137	2,987
Vermont	343	309	34	904	873	31	1,247	1,182	65	1,787
Virginia	908	796	112	4,113	3,847	266	5,021	4,643	378	16,974
Washington	593	507	86	3,117	2,830	287	3,710	3,337	373	7,116
West Virginia	221	179	42	2,204	2,010	194	2,425	2,189	236	10,985
Wisconsin	472	427	45	5,673	5,176	497	6,145	5,603	542	18,433
Wyoming	1,019	991	28	2,424	2,408	16	3,443	3,399	44	2,013
District of Columbia	17		17	131		131	148		148	59
Hawaii				538	506	32	538	506	32	579
Puerto Rico				576	440	136	576	440	136	1,021
Total	37,600	33,254	4,346	196,807	182,341	14,466	234,407	215,595	18,812	482,972

[1] Present traveled way.

Table 15.—Status of National forest highway projects as of June 30, 1954, and projects completed during the fiscal year [1]

State or Territory	Programed,[2] construction not yet authorized			Construction authorized, not started			Under construction			Completed during fiscal year		
	Total cost	Federal funds	Miles	Total cost	Federal funds	Miles	Total cost	Federal funds	Miles	Total cost	Federal funds	Miles
Alabama	$285,746	$142,873	10.1							$365,600	$182,800	21.1
Arizona	1,312,000	1,312,000	58.5	$448,000	$448,000	9.1	$609,500	$609,500	9.1	1,398,033	1,398,033	28.8
Arkansas	392,622	392,622	8.0				470,127	470,127	7.1			
California	2,130,900	2,130,900	41.0	3,096,200	3,096,200	23.2	2,279,100	2,279,100	14.0	4,031,260	4,027,010	26.7
Colorado	2,073,000	2,073,000	9.5	436,000	436,000	20.8	516,000	516,000	12.7	1,671,551	1,671,551	42.1
Florida	1,010,000	505,000	42.5				385,000	192,500	15.4			
Georgia							281,008	140,504	9.7	308,854	154,427	13.3
Idaho	2,848,300	2,848,300	84.5	1,240,000	1,240,000	49.7	1,809,000	1,809,000	23.8	2,698,552	2,698,552	50.3
Illinois	139,000	69,500	3.7									
Indiana	200,000	92,154	.2									
Kentucky										123,440	123,440	1.3
Louisiana	455,000	227,500	2.3									
Maine	558	558		8,011	8,011	1.6						
Michigan				53,400	22,340	3.0	522,100	438,550	28.3	924,178	463,185	22.3
Minnesota	448,147	448,147	6.8				547,000	547,000	10.5	145,000	145,000	.1
Mississippi	85,000	85,000	.1				418,041	301,747	4.2			
Missouri	327,069	327,069	9.0	98,000	98,000	.1	121,600	121,600	18.2	65,500	65,500	5.5
Montana	1,950,000	1,950,000	19.3	788,000	788,000	27.2	1,261,000	1,261,000	62.7	2,359,640	2,359,640	79.5
Nebraska										104,414	103,910	3.4
Nevada	390,000	390,000	5.5	225,000	225,000	15.7	575,000	575,000	4.2			
New Hampshire	360,000	360,000	3.0				62,000	62,000	.1	410,000	410,000	4.2
New Mexico	1,070,000	1,070,000	47.9	400,000	400,000	7.5	307,000	307,000	5.5	994,000	994,000	16.4
North Carolina	512,486	256,243	12.5	349,150	172,075	17.1						
Ohio										53,000	53,000	1.7
Oklahoma										189,173	93,950	3.7
Oregon	3,512,000	3,512,000	73.5	1,468,000	1,468,000	33.2	2,404,000	2,404,000	41.7	2,589,064	2,589,064	41.2
Pennsylvania	210,000	210,000	6.4				272,000	161,000	7.0			
South Carolina				99,700	34,692	6.5	233,000	111,800	17.8			
South Dakota	195,000	195,000	8.7				430,000	130,000	3.1	159,000	159,000	1.9
Tennessee	169,270	117,710	9.1	306,880	153,440	10.1	53,424	33,424	.5	32,834	16,417	7.6
Texas	58,400	29,200	4.0				177,800	88,900	.6	209,550	104,700	2.9
Utah	1,082,000	1,082,000	18.3	224,643	224,643	6.1	194,000	194,000	3.1	870,453	870,453	42.7

Vermont	195,919	97,959	2.0				67,900	67,900	.5			
Virginia	638,534	467,892	19.8				266,308	121,511	1.1	23,000	23,000	6.7
Washington	1,590,000	1,590,000	48.5	1,061,000	1,061,000	11.6	1,205,000	1,166,000	23.2	1,309,302	1,146,302	44.1
West Virginia	225,000	112,500	5.9							70,471	35,236	4.9
Wisconsin							318,035	159,018	9.2			
Wyoming	930,000	930,000	20.3	504,000	504,000	15.2	1,479,000	1,479,000	16.3	273,200	273,200	2.3
Alaska	1,502,000	1,502,000	12.6	868,037	868,037	6.1	1,028,000	1,028,000	6.1	866,500	866,500	7.0
Total	26,297,951	24,527,127	593.5	11,674,021	11,247,438	263.8	18,291,943	16,775,181	355.7	22,245,569	21,027,870	481.7

[1] Includes construction projects only.
[2] Initial commitment of funds.

Table 16.—Mileage of the National forest highway system, by forest road class and by State, as of June 30, 1954

Region and State or Territory	Total	Class 1 [1]	Class 2 [2]	Class 3 [3]
Western region:	*Miles*	*Miles*	*Miles*	*Miles*
Arizona	1,059.2	406.1	384.0	269.1
California	2,460.6	675.3	305.0	1,480.3
Colorado	1,507.0	583.0	466.0	458.0
Idaho	1,122.0	660.4	132.9	328.7
Montana	1,190.5	699.9	168.3	322.3
Nevada	318.8	157.2	130.8	30.8
New Mexico	652.0	204.0	293.0	155.0
Oregon	1,423.2	716.8	397.3	309.1
South Dakota	302.0	189.0	101.0	12.0
Utah	716.0	187.0	245.0	284.0
Washington	755.8	387.7	114.0	254.1
Wyoming	492.0	353.0	109.0	30.0
Alaska	365.9	----	----	365.9
Total	12,365.0	5,219.4	2,846.3	4,299.3
Eastern region:				
Alabama	367.0	64.0	216.6	86.4
Arkansas	633.6	96.7	536.9	----
Florida	288.2	33.0	194.6	60.6
Georgia	364.3	153.4	147.9	63.0
Illinois	306.8	245.8	30.5	30.5
Indiana	101.2	53.6	47.6	----
Kentucky	352.9	131.1	200.7	21.1
Louisiana	402.3	54.1	94.4	253.8
Maine	14.0	----	----	14.0
Michigan	1,169.6	582.1	531.5	56.0
Minnesota	718.8	256.5	292.3	170.0
Mississippi	522.7	257.2	229.6	35.9
Missouri	985.7	379.7	490.1	115.9
Nebraska	29.4	.4	11.6	17.4
New Hampshire	166.0	40.9	60.6	64.5
North Carolina	839.5	382.0	326.5	131.0
Ohio	133.6	70.4	34.1	29.1
Oklahoma	48.5	31.5	17.0	----
Pennsylvania	353.9	123.7	37.3	192.9
South Carolina	777.8	237.9	394.9	145.0
Tennessee	566.0	165.1	321.0	79.9
Texas	307.2	129.2	170.5	7.5
Vermont	119.1	32.7	61.9	24.5
Virginia	1,352.4	399.9	787.0	165.5
West Virginia	484.1	78.4	364.7	41.0
Wisconsin	473.4	76.7	294.4	102.3
Puerto Rico	36.0	----	----	36.0
Total	11,914.0	4,076.0	5,894.2	1,943.8
Grand total	24,279.0	9,295.4	8,740.5	6,243.1

[1] Forest roads which are on the Federal-aid rural primary system.
[2] Forest roads which are on the Federal-aid secondary highway system.
[3] Other forest highways.

Table 17.—Mileage of highways in National parks, monuments, and parkways constructed by the Bureau of Public Roads during the fiscal year

Park, monument, or parkway (and State)	Under construction as of June 30, 1954		Completed during fiscal year	
	Initial improvement	Stage construction	Initial improvement	Stage construction
	Miles	*Miles*	*Miles*	*Miles*
Acadia (Maine)	1.8			
Badlands (S. Dak.)	3.4			
Baltimore-Washington (Md.)	.7	8.2	11.6	6.8
Blue Ridge (Va.–N. C.)	4.0			
Foothills (Tenn.)			.9	
George Washington Memorial (Va.)				.9
Glacier (Mont.)	12.6			
Grand Canyon (Ariz.)	7.7			
Great Smoky Mountains (N. C.–Tenn.)				3.5
Lake Mead (Ariz.)			3.8	
Mount Rainier (Wash.)		7.6		.8
Natchez Trace (Miss.–Ala.–Tenn.)	16.7	33.8	7.4	
Olympic (Wash.)	.2		1.5	
Rocky Mountain (Colo.)	6.6			
Sequoia-Kings Canyon (Calif.)	2.9			
Shenandoah (Va.)		19.0		
Yellowstone (Idaho–Mont.–Wyo.)	3.5	2.8		
Total	60.1	71.4	25.2	12.0

Table 18.—Mileage of approach roads to National parks, monuments, and parkways constructed by the Bureau of Public Roads during the fiscal year

Park, monument, or parkway (and State)	Under construction as of June 30, 1954		Completed during fiscal year	
	Initial improvement	Stage construction	Initial improvement	Stage construction
	Miles	*Miles*	*Miles*	*Miles*
Grand Canyon (Ariz.)	9.7			
Zion–Bryce Canyon (Utah)		28.8		1.9
Total	9.7	28.8		1.9

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