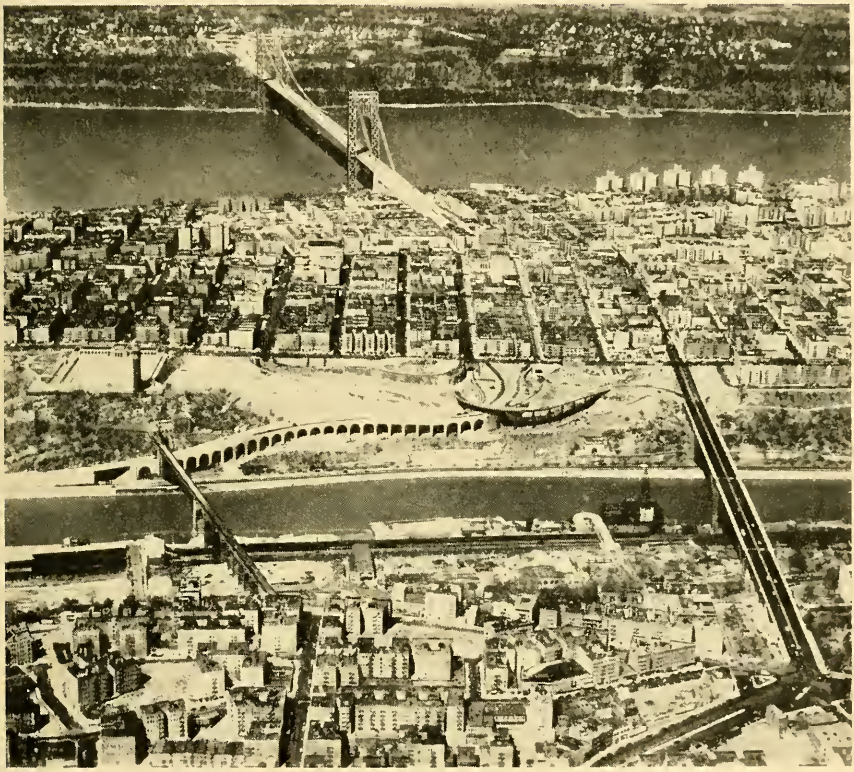
ANNUAL REPORT

Bureau of Public Roads

FISCAL YEAR 1952



The Highbridge Interchange in New York City

DEPARTMENT OF COMMERCE

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ANNUAL REPORT OF THE BUREAU OF PUBLIC ROADS

Factors Affecting Progress

FINDING an adequate solution of highway traffic difficulties continued to be one of the unsolved problems of the nation. Throughout the fiscal year 1952 [1] large construction programs were carried on which included construction of urban expressways, main intercity routes, and feeder roads. The volume of highway construction at least equaled that in any previous year. But this rate of progress is far too low in the light of actual highway conditions. Since the beginning of the war, highway surfaces have not been replaced as rapidly as they have worn out. About two-thirds of the Federal-aid primary and secondary highway systems is deficient in some respect and does not give satisfactory service to traffic.

Public demand for facilities over which vehicles could move without encountering congestion, delay, and danger was never stronger. Sections of expressways completed in cities and modernization of some sections of rural roads whetted the drivers' appetite for more of these improvements. Newspapers and magazines published articles analyzing traffic conditions and giving support to better highways. However, the rate of progress was controlled mainly by funds available and the highway program was not financed on a scale that promised adequate highway systems within a reasonable period of years.

National production rose to new high levels, reflecting the general prosperity of large and small businesses and of individuals. Highway use followed very closely the trend in production. Traffic on rural roads in the calendar year 1951 reached a new high for the eighth consecutive year. Traffic was 10 percent above that for 1950 and 53 percent above that for 1941. Urban travel was estimated at 6 percent above that of 1950 and 45 percent above 1941. Total travel on all roads and streets in 1951 was estimated at 490 billion vehicle-miles.

Main traffic arteries in or adjacent to large cities carried traffic volumes not dreamed of 20 years ago. Peak traffic volume in a 24-hour period in excess of 100,000 vehicles was reached by the North Outer Drive and South Outer Drive in Chicago, the Highway Bridge approaching Washington from the south, the Hollywood Freeway and Arroyo Seco Freeway in Los Angeles, the George Washington Bridge approaching New York, the Admiral Wilson Boulevard in Camden, N. J., and the Bay Bridge at San Francisco. All but two of these arteries had an average daily traffic in excess of 80,000 vehicles. These are exceptional traffic volumes, but they serve to illustrate a trend. There were a great many miles of highway badly congested by traffic of only a few thousand vehicles per day.

Continued increase in highway prices and shortage of steel were adverse to highway improvement. The upward trend in highway bid prices which started with the Korean trouble, at the beginning of the fiscal year 1951, continued at a diminished rate of rise throughout the fiscal year 1952. The increase during the year was 6.2 percent, which was considerably less than that of 15.6 percent during the previous year. The total rise since the beginning

[1] The fiscal year extended from July 1, 1951, to June 30, 1952.

of the upward trend was 22.7 percent. Prices at the end of the fiscal year were 49.9 percent above those for 1945.

During the fiscal year, highway construction labor, materials, and equipment costs increased 5.5 percent, 0.6 percent, and 1.6 percent, respectively.

Inability to obtain sufficient steel to meet highway requirements seriously delayed a large number of bridge projects already under construction and either prevented or discouraged the commencement of many new improvements that had been contemplated. The most critical shortages of steel were in the products used in the construction of large bridges, which normally constitute only about 15 to 20 percent of the total highway construction program. Therefore, despite the serious delays to structural projects, the Federal-aid highway program as a whole was able to proceed at a near-record rate, although with greater emphasis on the nonstructural portion of the work than would otherwise have been the case.

There was good competition among contractors for Federal-aid work. The average number of bidders per project was 4.6, which was slightly lower than in the previous year. During the year, approximately 4,500 Federal-aid highway contracts were awarded to some 2,000 contractors.

In the last half of the fiscal year, there was a marked increase in the awarding of contracts for Federal-aid and other classes of work supervised by State highway departments. The total of such contract awards amounted to $841 million as compared to $611 million in the same period of the previous year (fig. 1).

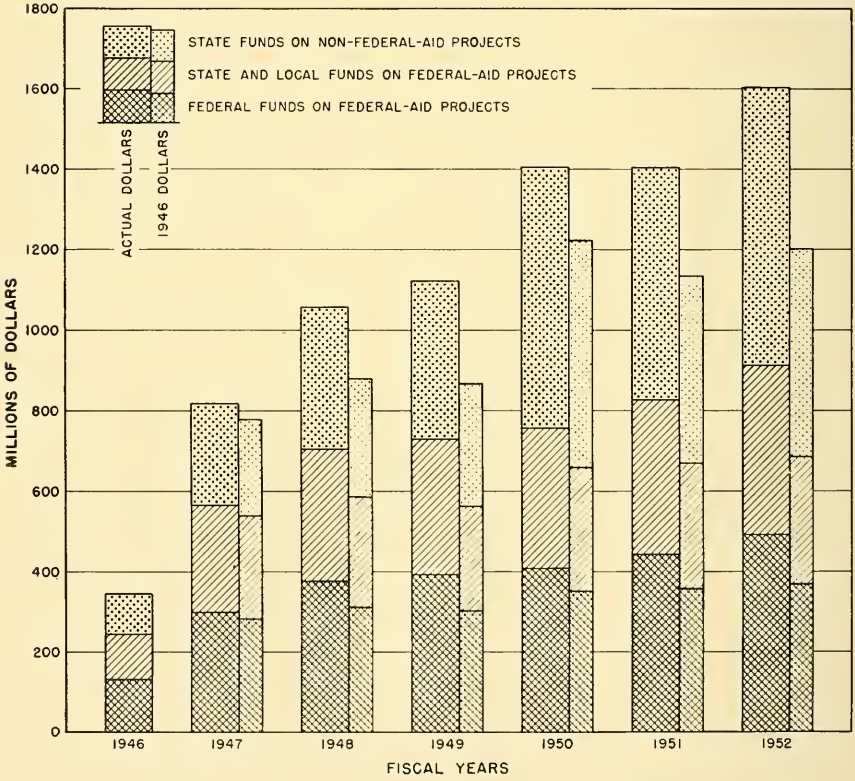


Figure 1.—Highway construction contracts awarded by State highway departments.

As the year advanced, highway departments found it increasingly difficult to obtain enough engineers and technical assistants to carry on their work. College graduates generally did not find jobs and salary scales offered in highway work attractive, and there were losses of technical personnel to defense activities. This trend, if continued, will result in delay in preparing plans for new improvements, since current construction is given first priority in assignment of personnel.

The Federal-Aid Program

Acceleration in the rate of project advancement during the last 6 months of the fiscal year raised the level of accomplishment in the Federal-State cooperative highway construction program to a new record high for the year. This upsurge in construction, coupled with Congressional approval of larger annual authorizations for the fiscal years 1954 and 1955, is a definite improvement in progress toward closing the wide gap now separating highway supply and highway demand.

The Federal-aid highway construction program was carried forward during the year with Federal-aid funds of $500 million authorized for the fiscal year and remaining balances of prior authorizations, together with State and local matching funds. All classes of Federal-aid projects completed during the year had a combined total length of 18,110 miles. This was less than the mileage of completions during the previous year, a result of the screening of projects with respect to defense essentiality and consequent deferral of some of the secondary system improvements. Completions of secondary projects decreased by 2,766 miles from the previous year's total, as contrasted to a decrease of only 1,921 miles in the total program. All projects were carefully reviewed during the year pursuant to the President's request of July 21, 1950, that programs be re-examined with the object of giving first priority to those which contribute directly to the defense effort or to essential civilian requirements.

Highway and bridge improvements were completed during the year as follows: On the Federal-aid primary highway system outside of cities (principal intercity routes), 5,627 miles of highways and 884 bridges; on urban portions of the Federal-aid primary highway system, 772 miles of streets and 363 bridges; and on secondary or farm-to-market roads, 11,109 miles of roads and 1,245 bridges. Progress in the long-term program of eliminating hazards to life at railway-highway grade crossings resulted in completion during the year of 133 crossing eliminations, reconstruction of 32 inadequate grade-separation structures, and protection of 341 crossings by flashing-light signals or other effective safety devices. Projects completed other than in the regular Federal-aid program amounted to 601 miles.

Restrictions on the use of steel, principally structural steel, reduced the volume of bridge work with the result that bridges constituted a smaller proportion of new plans approved than in prior years. The rate of submission of bridge projects requiring structural steel in the superstructure indicated a trend toward deferral of bridge work and use of designs requiring a minimum of structural steel.

Despite the scarcity of steel, record-breaking volumes of projects initiated by the States were advanced through the stages of program approval, plan approval, and contract award. Projects for the construction of 25,999 miles were programed during the year, and nearly all of the States were allotting funds apportioned for the fiscal year 1953 to programed projects. Contracts were awarded during the year for improvements to 20,462 miles of highways and streets. Construction put in place during the year amounted to 94 percent of the year's $500 million authorization. At the year's end, construction was in progress, or sched-

uled to begin soon, on 26,216 miles of highways and streets. Details of accomplishments during the year and the status of the program at the year's end are furnished by tables in the appendix.

Classes of Federal-Aid Work

Provision for continuation of an enlarged program of Federal assistance to the States during the fiscal years 1954 and 1955 was made by the Federal-aid Highway Act of 1952, approved June 25, 1952. This act authorized a total of $550 million for each of the two fiscal years for three general classes of highways—primary, secondary, and urban—and in addition, authorized $25 million each year for improvements to the National System of Interstate Highways.

The Federal-aid primary highway system.—Improvement of the network of principal highways included in the Federal-aid primary highway system has been continuous since 1921, when the Federal Highway Act provided for its designation. Forty-five percent of each year's authorization since World War II has been specifically designated for improvements on the Federal-aid primary highway system. Authorizations of primary funds for each of the fiscal years 1952 and 1953 amounted to $225 million. Primary funds of $247.5 million were authorized for each of the fiscal years 1954 and 1955.

The Federal-aid secondary highway system.—The Federal Government recognizes an interest in secondary or farm-to-market routes, rural mail-delivery routes, and school-bus routes by providing 30 percent of the total Federal-aid fund authorization for improvement of this class of road. Secondary fund authorizations of $150 million were provided for each of the fiscal years 1952 and 1953; for each of the fiscal years 1954 and 1955, the secondary fund authorizations have been increased to $165 million.

The Federal-aid urban primary system.—Federal funds for aiding in the construction of the modern expressway routes so urgently needed to eliminate serious traffic congestion in cities make up the remaining 25 percent of the annual Federal-aid authorizations. Urban fund authorizations were $125 million for each of the fiscal years 1952 and 1953; for the fiscal years 1954 and 1955, the urban fund authorizations have been increased to $137.5 million. Primary funds are also available for expenditure on improvements to the urban system, which comprises the urban portion of the Federal-aid primary highway system.

The National System of Interstate Highways.—Authorization of a fourth class of Federal-aid funds for improvement of the National System of Interstate Highways was contained in the Federal-aid Highway Act of 1952. For each of the fiscal years 1954 and 1955, $25 million was provided for this 37,800-mile system which Federal legislation had previously brought within the Federal-aid primary and urban systems. Approximately one-third of the primary funds and nearly one-half of the urban funds heretofore allotted to projects have been for improvements to the interstate system. Specific funds for the system have been authorized to encourage more rapid improvement of this selected system of interregional highways, important both as avenues of commerce and as routes of highest strategic importance in national defense.

Status of Work at End of Fiscal Year

Figure 2 shows the status of the Federal-aid program financed from funds currently available. The active program of projects for which plans had been approved or work had started at the close of the fiscal year (table 2 of the appendix) included improvements to 25,234 miles of highways and streets in the Federal-State cooperative program. The total estimated cost of these im-

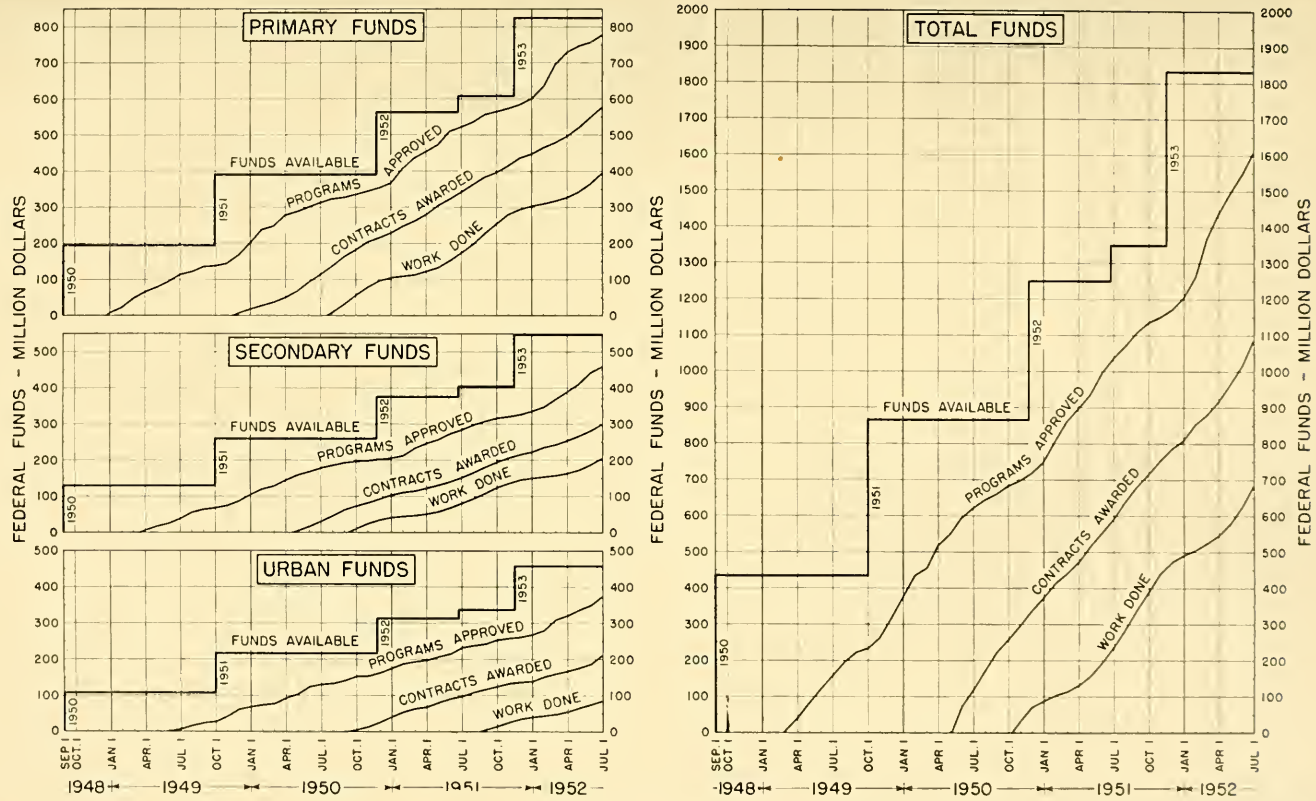


Figure 2.—Progress in approval of programs, award of contracts, and construction of projects with available Federal-aid funds.

provements was $1.73 billion, including $888 million of Federal funds. Included in this work was the elimination of 261 railway-highway grade crossings, the reconstruction of 37 obsolete grade-separation structures, and the protection of 317 grade crossings by the installation of flashing lights or other effective protection devices. Other work under the programs for improvements in National forests and parks, public lands, and for flood relief involved improvements to an additional 982 miles of highways at a total cost of $60 million, including $53 million of Federal funds.

The National System of Interstate Highways

The National System of Interstate Highways includes the most important routes of the country. Since it connects the different regions and most of the larger cities, it carries great streams of traffic. Its routes are used by, and are of direct interest to a greater number of people and businesses than any other equal highway mileage. Defense activity greatly increased traffic on the system and focused attention on the many improvements needed to provide economic transport. Examples of the inadequacies and obstruction to traffic flow and how they were being corrected are described in a following section discussing outstanding projects.

No Federal funds were provided, heretofore, solely for use on the interstate system. Improvements were made with funds provided for the Federal-aid primary highway system, of which it is a part, and for urban highway improvements. In response to a general demand for acceleration of the rate of improvement of the system, the Federal-aid Highway Act of 1952 provided $25 million for exclusive use on the system in each of the fiscal years ending June 30, 1954, and June 30, 1955.

Progress in improving the system was somewhat better than in the preceding fiscal year. Thirty-six percent of the Federal-aid primary and urban funds assigned to projects approved for construction were for improvements to the interstate system. Projects completed during the year involved improvement of 1,232 miles at a total cost of $192,986,659, of which $98,211,572 were Federal funds. At the end of the year, construction was under way on 1,620 miles at a total cost of $398,120,670, including $199,361,762 of Federal-aid funds. In the preceding fiscal year, slightly over 1,000 miles were completed and at the end of the year 1,516 miles were under construction.

Improvement of Urban Highways

The continued increase in travel produced its most pronounced effect in urban areas, since approximately half of all motor-vehicle travel is on city streets. Based on counts made in 41 cities, it was estimated that 1951 travel in urban areas was 6 percent greater than in 1950 and 45 percent greater than in 1941. Every city struggled with problems of congestion, delay, and accidents. For some years there has been general acceptance of the fact that free movement of traffic can be accomplished only through provision of expressways for the largest streams of traffic, improvement of distributor streets, and creation of parking facilities and terminal facilities for trucks and busses. Activity toward these ends was greater than in previous years. Practically every city had major highway projects under way and was attacking the parking and terminal problems with greater energy than in past years.

The Federal urban highway program has been directed toward assisting the cities in their most difficult and costly work—improvement of main traffic arteries. Analysis of the Federal-aid urban highway projects approved during the three fiscal years ending June 30, 1952, shows that the funds are being

used for work that will improve the flow of traffic rather than for replacement in kind of worn-out surfaces.

Projects were approved totaling almost 1,000 miles and involving Federal participation in excess of $363 million in a total cost of over $700 million. Sixty-five percent of these funds were being used on expressway construction; 14 percent on multilane divided highways without controlled access; 12 percent on projects which provide at least one additional traffic lane; and less than 1 percent on minor improvements which will facilitate the flow of traffic on existing highways. About 8 percent of the urban funds were being used to eliminate hazards resulting from highways crossing railways at grade.

Use of Federal-aid urban funds is limited to the improvement of routes of the Federal-aid urban primary system. These are the arterial routes carrying the largest volumes of traffic. The effect of improving these routes is more far reaching than the relief of congestion in the immediate areas through which they pass. These routes form the urban road system which determines the general city plan of development. They outline neighborhoods and carry traffic between different areas in the city, and between these areas and the central business district.

The functioning of a city's motor-vehicle transportation is not complete unless all phases are brought to a desirable standard, and the improvement of the Federal-aid urban primary system encourages and sets the pace for solution of other transportation problems. These problems include (1) the improvement of distributor streets, because people and goods are delivered finally to home, store, and factory on streets serving them directly, (2) the improvement and development of terminal facilities such as parking areas and off-street loading docks to release the arterial routes and streets for moving vehicles, (3) the improvement of the transit system to give better service and reduce interference between mass-transit vehicles and other moving vehicles—in many instances improved arterial routes have aided mass transit by providing better facilities for busses, with resulting reduction in operating time—and (4) better traffic control and enforcement to insure coordination in the operation of all parts of the transportation system.

Work on Outstanding Federal-Aid Projects

An impressive feature of the year's work was the number of outstanding projects being built in all sections of the country. At the end of the war there were few divided highways with controlled access. By the end of the year many had been completed or were under construction. They were found not only in the larger cities but in cities with populations as low as 40,000 or 50,000. Most often the projects were sections of much more extensive improvements which, because of the cost, would have to be spread over a period of years. Typical examples of expressways and other improvement are described in the following paragraphs.

East Boston Expressway.—Completion of the East Boston Expressway was scheduled for the fall of 1952. This 1¼-mile, six-lane divided highway, a section of the National System of Interstate Highways, will bring welcome relief to the 23,000 motorists who have suffered daily from lack of an adequate highway link connecting the vehicular tunnel under Boston Harbor with the North Shore highways and the Logan International Airport. Traffic has been forced to use congested local streets in one of the most densely populated areas of Massachusetts. The result has been hours of delay to thousands of people and about 100 accidents and 5 fatalities each year.

Built entirely on new location and partly elevated, the new expressway embodies the most advanced features of highway design. Providing for the complete separation of opposing traffic, the elimination of cross-traffic and conflicting movements at intersections, and the removal of pedestrians, the

The East Boston Expressway, looking northward. In the foreground, the Sumner tunnel ramp is at the left, ramps to the Logan International Airport at the right.

expressway will permit through traffic to move safely and without interference on this important section of our highway system. Local traffic will move with greater safety and freedom on the existing city streets. An independently constructed bus and rapid-transit station being integrated with the expressway will provide connection between busses serving the busy Logan International Airport and the metropolitan transit system. When the Boston Central Artery, now under construction, and a proposed second vehicular tunnel under Boston Harbor are completed, it is expected that the traffic on this expressway will increase to 45,000 vehicles per day.

Highbridge Interchange in New York City.—One of the most difficult traffic sorting and distribution problems ever encountered was in New York City near the end of the George Washington Bridge. Great streams of traffic pour into the area over the George Washington Bridge, the Cross-Bronx Expressway, Harlem River Drive, and the Henry Hudson Parkway. Traffic is composed of all classes of vehicles in through and local movement with wide diversity in destinations.

Traffic over the George Washington Bridge has been as high as 123,000 vehicles in one day, and it is expected that 20,000 vehicles will travel the expressway across the Bronx each day when it is fully completed. Much of the traffic through the area, in order to reach the desired route, has been forced to use heavily congested streets that were narrow and twisting. Time was lost because of traffic lights, parked vehicles, streetcar tracks, and elevated railway columns.

The Highbridge Interchange, an intricate array of structures and looping roadways, was completed as a Federal-aid project and provides the means of ready and unobstructed movement from one route to another. Two tunnels, one of them newly constructed by the Port of New York Authority, connect the interchange with the George Washington Bridge.

Traffic of the great number of defense industries in New York City and north, south, and west of the city will benefit greatly from the improvement.

In the cover picture of this report, the Highbridge Interchange in New York City is shown at the center of the picture, the George Washington Bridge across the Hudson appears in the upper portion, and the other stream is the Harlem River. Harlem River Drive is along the far bank of the Harlem River, and the Henry Hudson Parkway (not visible) is along the near bank of the Hudson. The Cross-Bronx Expressway is at the right.

U S 60 in West Virginia.—The great amount of traffic using Interstate System Route U S 60 between the West Virginia-Kentucky State line and Gauley Bridge in West Virginia strongly indicates great need of a four-lane highway throughout this 100-mile section. Charleston lies near the midpoint of the section and many industrial plants are strung out along it. West Virginians call the area the chemical capital of the world. Of the total length about 30 miles are city streets and approximately 30 miles now have a roadway of 40 feet or more. This includes the wider city streets and four-lane rural sections. Traffic using the road varies from 4,400 vehicles a day in a rural county to about 26,000 in Charleston. All improvements undertaken on this section have been planned for ultimate development as a four-lane highway. An illustration shows the character of improvement made at Gauley Bridge.

The four-lane divided highway completed at Gauley Bridge in West Virginia.

A secondary road in Georgia.—The economic growth of Charlton County, located in the piney woods of southeast Georgia between the Okeefeenokee Swamp and the St. Marys River, was severely retarded during the 1940's due, at least in part, to the inadequate highways serving the county. Population decreased from 5,256 in 1940 to 4,821 in 1950, or 8.3 percent. An illustration shows an inundated road typical of conditions that occurred each spring.

Since the end of the war improvements have been completed on a Federal-aid secondary route from St. George north to Folkston and easterly, paralleling the St. Marys River, to the town of St. Marys on the Atlantic coast, where a huge paper plant is located. Improvement has also been completed from St. George westerly 12 miles to Moniac. Thirteen inadequate bridges subject to washout annually on the 23-mile section between St. George and Folkston have been replaced. With the improved highway and bridges, timber and naval stores are produced and delivered throughout the year rather than on a seasonal basis.

A secondary road in Georgia near the Okeefeenokee Swamp before improvement, and another section of the road after improvement.

Traffic between St. George and Folkston has increased from less than 100 vehicles daily in 1946 to over 500 vehicles daily in 1951. Improvements were still under way on the 12-mile section south of St. George to the Georgia-Florida State line. When this section is complete another substantial increase in traffic is anticipated, as a direct connection will be made with the Florida highway system at MacClenny, Fla., which will provide an alternate route to the truck and citrus producing areas of central Florida.

U S 90 in Alabama.—U S 90 in Alabama is the principal route roughly paralleling the Gulf coast, carrying traffic from cities along the coast to New Orleans. It is a part of the National System of Interstate Highways. On the 26-mile section between Mobile and the Alabama-Mississippi State line, traffic ranged from 10,000 vehicles per day near Mobile to 3,000 per day on the westerly portion. The narrow pavement, sharp curves, and restricted sight distances on the old road seriously obstructed traffic. This was particularly true of the section in and near Mobile where traffic was heaviest.

This road has been modernized by relocating 8 miles, construction of 11.5 miles as a four-lane divided highway, and widening the remainder to 24 feet. In 1951 there were 110 accidents on the old road outside of Mobile, resulting in injury to 76 persons and 4 deaths. The State highway patrol reported a 50-percent reduction after the opening of the new road.

Circumferential road at Meridian, Miss.—Through and local traffic on U S 11 and U S 80, which are coincident in the vicinity of Meridian, are saving 50 percent in travel time and 18 percent in travel distance since a new road was completed

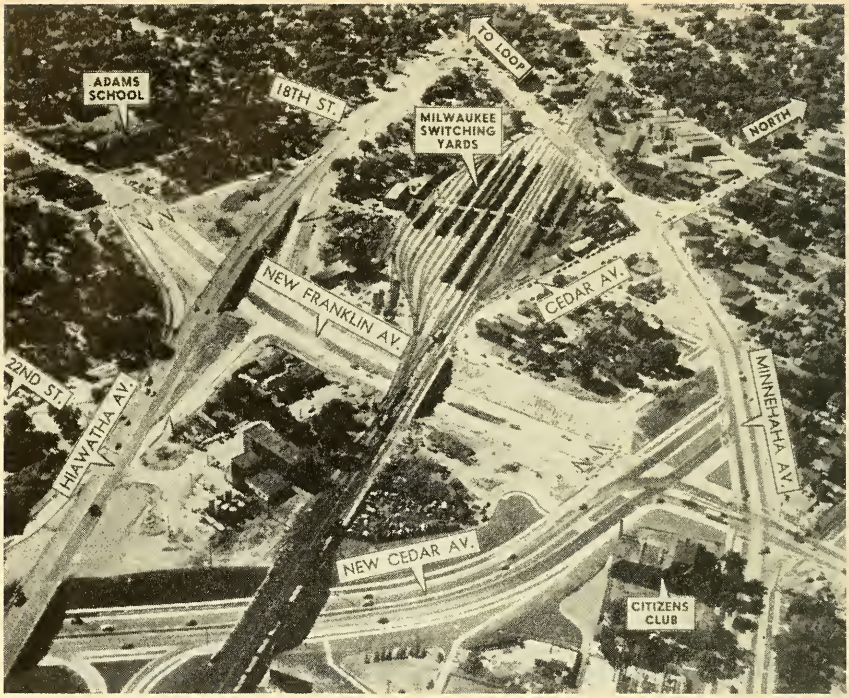
The new four-lane highway on U S 90 approaching Mobile.

and the old route through the business district of the city abandoned. Access to the business district is afforded by several conveniently located streets which intersect the new highway. The four-lane divided highway, constructed to interstate standards, was completed in August 1951. The new highway skirting the city is 5.8 miles long and has two railroad-highway grade-separation structures and one bridge. An intersection with U S 45 was left at grade, but when traffic volumes warrant it the highways will be separated by a structure, and connecting ramps provided. Interchange for traffic to and from U S 11 south from Meridian is provided by two double-lane ramps. When the new facility was opened, traffic amounted to 4,000 vehicles per day.

Chicago's new expressway.—A 14-mile section of Edens Expressway extending north of Chicago was opened to traffic this year. Replacing the old Skokie route, this six-lane divided highway, constructed to interstate highway standards including full control of access, not only eliminates congestion and reduces the high accident rate formerly experienced on U S 41, but also reduces the average travel time by about 17 minutes. Completed at a cost of $22 million, this modern facility has been estimated to save motorists over $3 million annually in terms of accidents, time, tires, and gasoline.

Illumination was being installed at the end of the year for its entire length, and will improve the night driving conditions, adding another safety factor. Passing through an attractive suburban area, the aesthetic values were maintained by careful attention to the architectural treatment of structures and development of the roadside.

Plans were being prepared for an extension south to connect with the projected Northwest Expressway which will give direct access to the Chicago Loop area.



Separations of railroad and highway grades in Minneapolis as work neared completion. Travel of 50,000 vehicles daily will be facilitated by these improvements.

Traffic counts showed 25,000 to 35,000 vehicles per day on the completed highway, and estimates indicate a daily volume of more than 40,000 vehicles when expressways are in operation to downtown Chicago. When completed, travel time via the Edens and Northwest Expressways to the Loop will be reduced from the 1 hour and 10 minutes required on the old route to about 45 minutes.

Grade separations in Minneapolis.—A fifty-year dream was rapidly approaching realization at a railroad crossing in Minneapolis. Separation of the railroad grade from the grades of intersecting streets and trunk highways has been a public issue since before World War I. Matters relating to the grade crossings have been the subject of city ordinances, lawsuits, court orders, injunctions, and appeals from time to time throughout the years. With each passing year the congestion and delays at crossings became more and more intolerable.

Finally, in 1948, work on the first phase of the over-all plan for development was begun. Four years later, the improvements were almost ready for traffic. They consist of four structures (two railroad-highway and two highway-highway grade separations) and a modern four-lane divided highway. Federal-aid funds were used to pay approximately 55 percent of the total cost of the improvement.

Traffic on the two trunk highways and one city street was estimated to be approximately 50,000 vehicles per day, and a large increase was anticipated after completion.

U S 30 relocated around Cedar Rapids, Iowa.—Work was under way on the relocation of U S 30 east of Cedar Rapids for a distance of 15 miles, avoiding the industrial district and all but a small portion of the residential area of the city. The new location also avoids the built-up sections of the cities of Mt. Vernon and

Lisbon. It was estimated that through traffic will save at least one-half hour driving time and congestion in Cedar Rapids will be materially reduced when the work is completed, even though the saving in distance will be negligible. The new road crosses one railroad switchtrack at grade, and two main-line railroads over grade-separation structures. Excavation required in constructing this road is in excess of 1.85 million cubic yards.

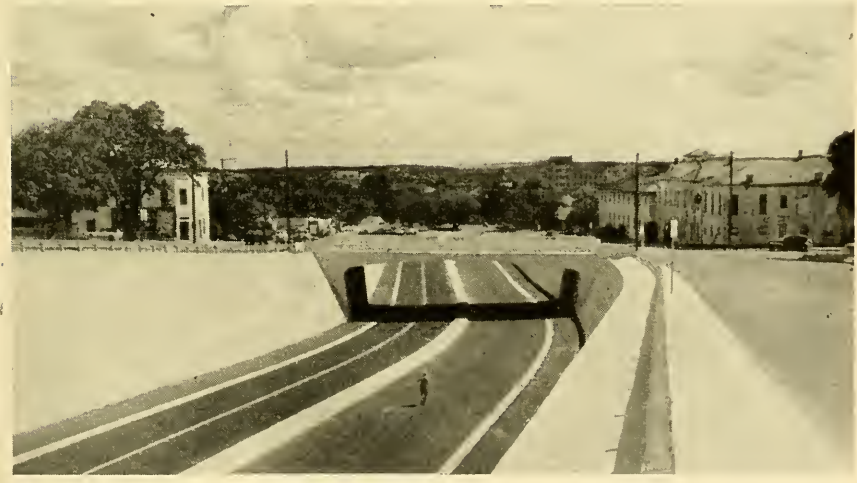
The old route of U S 30 traverses the industrial and residential areas of Cedar Rapids for a distance of 5 miles. There are four railroad grade crossings. East of Cedar Rapids the pavement is only 18 feet wide, with several sharp curves and narrow bridges. There have been 267 accidents on the old road during the last 5 years. The new road will greatly reduce the accident rate because of improved width, alinement and visibility, and elimination of grade crossings.

Austin Expressway.—The first segment of East Avenue Expressway in Austin, Tex., was put into service near the end of the year and used for local travel. This 1.7 miles of controlled-access, multilane highway has five grade-separation structures, and is the first section of 21 miles of improvement of U S 81 that will extend 7 miles north and 7 miles south of the city. This section of highway is also part of the interstate system. Service roads and frontage streets will be provided throughout. The ultimate improvement will have 22 grade-separation structures and one major bridge when completed. Its location skirts the congested areas of Austin and will form an important link in the future improvement of U S 81 between San Antonio and Fort Worth.

A traveler over U S 81 following the old route through Austin will encounter 49 traffic lights or stop signs at cross streets. Through traffic alone on U S 81 at Austin has been almost 9,000 vehicles daily. Daily traffic near the University of Texas campus has averaged over 24,000 vehicles.

Hollywood Freeway in Los Angeles.—For 12 years the Hollywood Freeway has been the number one freeway project in California. It is the backbone of the metropolitan Los Angeles freeway system, being 10 miles in length, beginning in the heart of Los Angeles and extending northwesterly through Hollywood and Cahuenga Pass to Vineland Avenue in the San Fernando Valley.

The first section, 1½ miles in length, in Cahuenga Pass was opened to traffic in 1940. The work was financed with city, Federal, and State funds. Further



Controlled-access expressway in Austin, Tex.

construction was delayed by World War II and the lack of State funds. A second unit, 2 miles in length, was completed in 1949, and a third unit in the heart of Los Angeles was opened to traffic in 1950. Among other notable features the section has a four-level grade-separation structure. Two sections, totaling 2½ miles in length, were completed during the fiscal year and work was well under way on the last section.

The Hollywood Freeway is an important link in the interstate system and of U S 101, which extends from Mexico to Canada along the Pacific coast. The freeway is the culmination of the cooperative efforts of city, county, State, and Federal officials in solving difficult location and financial problems.

The value of the freeway is indicated by the volume of traffic using it. An average of 30,000 vehicles per day were attracted to the third section in the heart of the city when it was opened in 1950. Traffic increased to 45,300 vehicles per day when the next unit was opened, and to 70,000 vehicles per day when the entire section between Spring Street and Western Avenue was available. The volume of traffic has increased steadily as the public has realized the benefits derived from traveling on the freeway, until at the end of the fiscal year the Spring Street-Western Avenue section was carrying 90,000 to 100,000 vehicles daily. It is obvious that the freeway will be used to capacity when it is completed.

The freeway has six to eight traffic lanes throughout its length, with all cross traffic eliminated. Although it has cost many millions of dollars, its cost will soon be more than offset through savings to motorists in operating expenses and travel time. Of greater importance to the traveler is the convenience and safety resulting from use of the freeway. On the adjoining Arroyo Seco Freeway, the

The Hollywood Freeway will ease congestion on Aliso Street (inset) in Los Angeles.

fatality rate during the year 1948 was 0.48 per million vehicle-miles as compared with 2.53 per million vehicle-miles on Wilshire Boulevard, which carries approximately the same volume of traffic (40,000 vehicles per day). It is expected the Hollywood Freeway will have a more favorable record because of additional safety features that were not built into the Arroyo Seco Freeway. Los Angeles will also benefit by removal of through traffic from many local streets and the lessening of traffic congestion.

Roads to serve a Washington irrigation project.—Water for irrigation from Lake Roosevelt, formed behind the Grand Coulee Dam, was made available to the first block of arid land in the Columbia River basin early in 1952. A canal system was under construction to transform some 500,000 acres of sagebrush land to highly productive agricultural land in the course of about 10 years. Later construction will add another 500,000 acres, much of which has been marginal land producing wheat by dry farming.

A year ago there was no need for a road system. It has been determined that in excess of 1,200 miles of new county roads will be required to serve the area now. The most important of these roads are termed "arterials" and are placed on the Federal-aid secondary highway system, as blocks of land are divided into farm units and placed under irrigation. At the end of the year 134 miles of arterials had been placed on the system and 49 miles of Federal-aid projects had been placed under construction. Plans were in various stages of completion for an additional 33 miles to be placed under construction at an early date.

Portland-The Dalles Expressway.—One of the first great highways in the United States was the Columbia River Highway, built about 40 years ago. Constructed through the gorge of the Columbia River in Oregon, it has been justly famed for scenic beauty, skillful engineering, and traffic service.

In the 1920's this highway was famed throughout the country as the peak of perfection in highway improvement. Its scenic attractions remain unmarred, but many of its builders have lived to see its abandonment ordered because of obsolescence and unfitness for the traffic that exists.

The new Columbia River highway. The old road is on top of the promontory at the right.

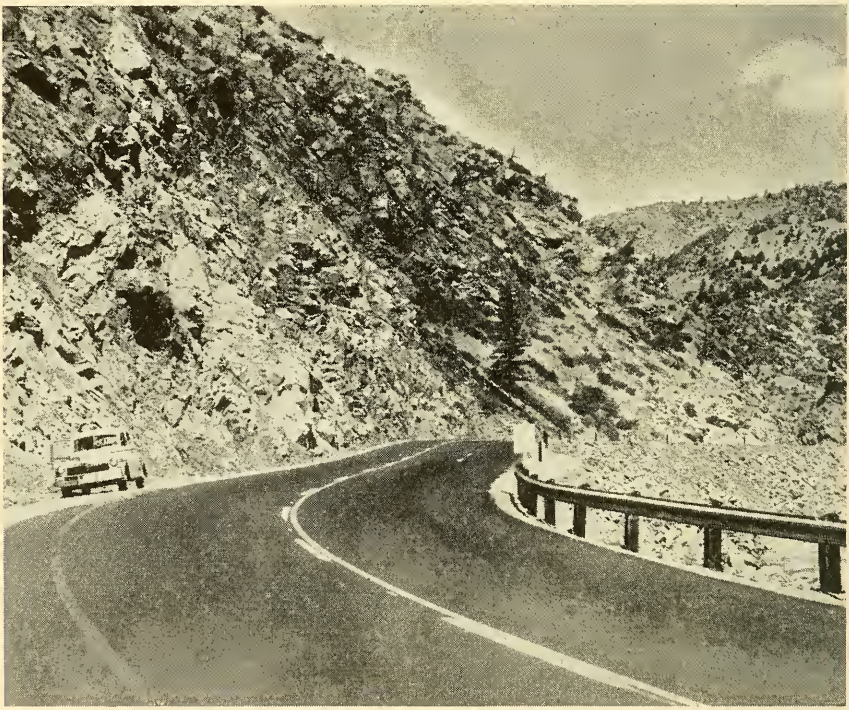
As a replacement, Oregon was building an expressway 82 miles in length from Portland east to The Dalles. This expressway is a part of U S 30 and is on the National System of Interstate Highways. The 16 miles within and immediately east of Portland is of six-lane and four-lane construction. The other 66 miles is to have two lanes. In contrast with the old highway, there are to be no sharp curves, and deviation of highway grade from normal water level of the Columbia River nowhere exceeds 200 feet. Construction has been made difficult by narrowness of the ledge between the river and the walls of the gorge and by the presence of a main-line railroad. Much of the roadbed is at the river's edge, constructed by hydraulic dredging methods and protected by rock bulkheads and riprapping.

All crossings of railroads, highways, and streets are separated crossings. Points of access are limited to an average of about one in three miles.

Twenty-eight miles are already completed, 34 miles were under construction at the end of the year, and 20 miles remained to be placed under contract.

There will be some loss in scenic values, since the old highway climbed to elevations 800 or more feet above the river, but proximity of the expressway to the Columbia River, together with the rugged nature of the river gorge, will make the new highway almost as scenic as the old one. Certainly travelers will view the scenery in greater safety.

Colorado's Clear Creek Canyon highway.—Colorado's historic Clear Creek Canyon, used by prospectors and a transcontinental stage-coach line during the 1860's, and later by a narrow-gage railroad, is again serving as a link in one of the nation's main transcontinental highway routes. Completion of a modern highway from a point on U S 40 approximately 7 miles west of Denver, north-



Clear Creek Canyon highway in Colorado.

westerly through Golden and thence up Clear Creek Canyon to rejoin U S 40 at the west end of Floyd Hill, a total distance of 18 miles, culminates 13 years of construction begun in 1935.

The canyon, with its easy gradient, has long been eyed by road constructors as an alternate route for U S 6 and 40 entering Denver from the west, and as a means of providing more direct access to the colorful mining towns of Central City and Blackhawk. Slow moving, bumper-to-bumper traffic has existed during peak periods on the Floyd Hill route for some time, even though the highway has been widened to three lanes throughout most of its length. Now, with both highways in operation, traffic flows unimpeded, resulting in great savings in time and fewer accidents.

From the eastern junction with U S 40 on into Golden, the new highway has four lanes divided by a median. Within the canyon, two lanes for traffic and adequate shoulders for parked vehicles are provided. The road surface is at least 12 feet above streambed, and is protected from stream damage during the frequent rampages of Clear Creek by stone retaining walls and heavy rock fills. Six tunnels totaling three-fourths mile in length bypass sharp turns in the canyon, and permit a speed of 30 miles per hour for the lower 5 miles, and 40 to 50 miles per hour on the remaining portion. Throughout the canyon's length, a 40-foot streambed has been provided to avoid damage by floods.

This highway was opened in July 1952. Saving in distance between Denver and Central City is approximately 6 miles, and traffic counts indicate its popularity is much greater than expected.

Secondary or Farm-to-Market Roads

Good progress was made in the actual construction of roads, and also in the development of plans of action by the States and their counties for carrying out the intent of the Federal legislation.

The tangible progress during the fiscal year is evidenced by more than 11,000 miles of road improved. The standards of construction for these improvements varied widely. In one western North Dakota county, for example, the emphasis is on building a limited mileage each year of well-constructed snow-free roads to serve rural community needs. The principal item of construction cost is the earthmoving to elevate the roadbed so that the wind will sweep the snow off the road. The surfacing is principally gravel, which is low in cost since gravel deposits are plentiful. Other counties, such as in parts of Oregon and Washington, do not have the snow-wind problem, but to serve the local economy they must build roads to carry the tremendous loads of logging trucks. Here a much larger proportion of road funds must go into the construction of bases and surfaces.

Wide distribution of the benefits of the program in rural areas is an objective of the Federal legislation. How well this is being accomplished is indicated by the fact that since the program was initiated in 1945, projects have been completed or initiated in 2,961 of the 3,070 counties in the United States, or 96.4 percent of them. Twenty-two States have had projects in every county. Eleven States have had projects in all but one county. And none of the remaining States have had projects in less than 80 percent of their counties.

To be eligible for improvement with Federal-aid secondary funds, roads must first be selected by the State highway department in cooperation with appropriate local highway officials, and approved by the Bureau for inclusion in the Federal-aid secondary highway system. At the end of the fiscal year, that system included 438,033 miles of which about 57 percent were under county control and 43 percent were the financial responsibility of the State highway departments.

The increase in traffic after construction of secondary projects in Texas is a good indication of how careful selection of potentially important routes for inclusion in the system, and careful determination of priorities for improvement, provide the greatest service with limited funds. Also indicated is the care with which standards of construction must be determined to prevent the building of roads of such low standard that they will be unable to carry the increased traffic which the improvements induce. The traffic on 234 postwar Texas Federal-aid secondary projects, totaling approximately 1,700 miles, was examined to determine the increase in traffic after improvement. The results are indicated in table 1.

Table 1.—*Increase in traffic on 234 secondary roads in Texas after improvement*

Vehicles per day, before improvement	Increase in traffic			
	First year	Second year	Third year	Fourth year
	Percent	*Percent*	*Percent*	*Percent*
Under 100	107	146	174	255
100–199	57	93	113	128
200–399	22	28	41	47
All projects	57	85	103	125
Entire State system	4	27	35	53

Considerable progress also was made in the establishment of secondary road units in the various State highway departments in accordance with the requirements of the 1950 legislation. Section 2 of the 1950 act requires that . . . "Any State desiring to avail itself of the benefits of the funds apportioned for expenditure on the Federal-aid secondary highway system shall establish in its State highway department within six months after the close of the next regular session of its legislature, a secondary road unit and such department shall be suitably organized to discharge to the satisfaction of the Secretary of Commerce, the duties herein required . . ." The primary responsibility of a secondary road unit in a State is that of establishing and maintaining cooperation between the State highway department and the counties in the selection of extensions and additions to the Federal-aid secondary highway system, in the selection of projects and determination of the specifications for the improvement of projects, and in the supervision of the construction and maintenance of such projects. Some States already had units in operation before enactment of the 1950 legislation. Others had authority under existing statutes to set up units by administrative action, while still others have found it necessary to obtain legislative authority for establishing a unit.

The organization plans submitted to the Bureau by the States were examined for compatibility with the over-all objective, which was to assure the same degree of technical and administrative competence in the construction and maintenance of secondary roads as is obtained on the State highway system, and as a means to that end, to bring about the development of self-sufficient county engineering organizations able to assume full responsibility in a continuing long-range program. At the end of the fiscal year, approval had been given to the organizational plans submitted by 36 States and Hawaii. Approval in three States and Puerto Rico was awaiting additional information. Approval in nine other States was pending.

Throughout the secondary road program the Bureau has depended on a board of county consultants for advice and counsel in administrative matters, particu-

larly affecting the counties. The board, since 1946, has been composed of 10 county engineers, one from each of the operating divisions of the Bureau. The counsel of the board members is regarded highly and the board is being continued.

Activities as Claimant Agency Under Controlled Materials Plan

The functions of the Bureau as claimant agency for highways under the Controlled Materials Plan were continued throughout the fiscal year. The Bureau's jurisdiction under the delegation of authority from the Defense Production Administration and the National Production Authority covered construction and maintenance of all rural and urban highways, streets, highway equipment, repair shops, bridges, tunnels, toll-road facilities, appurtenant installations, and publicly owned parking facilities incident to a highway or street, regardless of financing and regardless of whether they are under the supervision of a Federal, State, or local government agency or a special commission. The delegation of authority has been interpreted to cover also traffic-signal installations and publicly owned street-lighting systems, although these items are not specifically mentioned.

The principal functions of the Bureau as claimant agency were as follows:

1. Assembled and presented to the Defense Production Administration the estimated requirements by calendar quarters of controlled materials (steel, copper, and aluminum) for highway purposes; analyzed construction plans of operations and timing of work on specific large projects to assure that various segments of the project would be ready to receive and utilize steel in the calendar quarter for which requirements were submitted; established policies regarding construction planning and timing for steel purposes.

2. Advocated these estimated requirements before the Defense Production Administration by means of written statements, hearings, and appeals in an effort to obtain adequate over-all allotments of these materials to meet the estimated requirements for a minimum essential construction program.

3. After the over-all allotment for a quarter and advance tentative authorizations for subsequent quarters were received, established quotas for each State and Territory based on the essentiality of the requirements submitted.

4. Received and reviewed applications from the States, counties, cities, toll authorities, and other highway agencies for authority to commence construction and for allotments of controlled materials for individual projects.

5. After considering the applications and relative essentiality and urgency of the proposed projects, determined the particular projects for which the available steel, copper, and aluminum should be allotted, and then authorized commencement of construction and issued allotments accordingly.

6. Granted the right to use D. O. priority ratings to assist in procurement of scarce materials, other than the three controlled materials, needed in construction work.

7. Adjusted quarterly quotas among the States from time to time to conform to changing needs as they developed.

8. Obtained priority ratings from the National Production Authority to assist contractors and public agencies in procuring the equipment units they required to perform highway construction and maintenance work.

9. Consulted with and advised various committees and representatives of the Defense Production Administration, National Production Authority, the other claimant agencies, and industry relative to regulations and procedures as they affected highway work.

10. Advised applicants and other interested parties regarding required procedures, interpretation and applicability of regulations, reasons for delays, and

best solutions of other problems involved in obtaining the desired allotments of materials and authority to commence construction.

In the exercise of its claimant agency functions the Bureau enlisted the aid of the State highway departments. At the request of the Bureau the State highway departments dealt with counties, cities, toll authorities, and special commissions to ascertain their estimated requirements; made the original screening of proposed projects to eliminate those not conforming to established criteria of essentiality; and submitted recommendations as to how the limited allotments of controlled materials should be distributed among all the eligible projects within the State. In all operations of the Bureau and the State highway departments, special care was taken that the needs of city, county, other local highway departments, and special commissions were appropriately presented to the Defense Production Administration and given full consideration in allotment of steel to projects.

Since the over-all allotments of controlled materials for highway purposes were inadequate to meet the requirements for all essential projects, it was necessary for the Bureau and the respective State highway departments to investigate thoroughly each proposed project to determine its requirements and relative importance and urgency. Furthermore, in order to check on the justification for requested priority ratings to assist in procurement of construction and maintenance equipment, it was necessary to check the equipment inventories and needs of the hundreds of contractors and public highway agencies requesting priority ratings. As a result, the Bureau and State highway department engineers had to become intimately acquainted with the highway needs and problems of the counties, cities, toll authorities, and contractors as well as with those of the States and Federal governments. The working relations and mutual understandings that have necessarily been developed through these cooperative efforts will be of inestimable value to all highway organizations in carrying on their respective highway functions in the future.

The evidence that has been assembled and presented in justification of requirements of controlled materials for highways has done much to effect greater recognition of the vital importance to national defense and the civilian economy of providing for an adequate and continuing program of highway rehabilitation and improvement. The sufficiency rating system, developed by the Bureau and State highway departments to indicate by a numerical rating the sufficiency of each individual section of highway to provide for traffic requirements, proved very effective in gaining acceptance of the actuality of highway needs and of the reliability of the estimates of controlled material requirements for highway purposes by the DPA requirements committee and numerous other claimant agencies.

Throughout the fiscal year the controlled materials allotted for highway work were considerably less than actual requirements for essential projects. This situation was aggravated by the fact that, even after the necessary allotment was obtained, it frequently was not possible to find a mill that would accept the rated order for the steel. Substantial portions of the allotments for the third and fourth quarters of the 1951 calendar year were lost because of inability to place the orders and the consequent necessity of revalidating the allotments to later quarters, thus superimposing these requirements on top of the regular requirements for the later quarters.

By the first part of the 1952 calendar year the situation had improved considerably. Less difficulty was encountered in placing orders, and prospects were bright for increasingly larger steel allotments for future quarters, with some expectation that the steel supply might become adequate to permit complete removal of controls within a few months. Then, in June, came the general work stoppage

in the steel industry. Inasmuch as production had not been resumed at the end of the fiscal year, the ultimate effect on the highway program could not be appraised.

Highway Improvement Under Direct Supervision of the Bureau

The Bureau receives annual appropriations for the construction and maintenance of the major highways through National forests, and performs a large amount of highway engineering and construction supervision for other Federal agencies.

The extent to which the Bureau enters into the highway work of other agencies varies considerably. In some cases cooperative action under jointly approved regulations is required by law in the planning of highway systems and programs, with the Bureau in direct charge of all engineering and construction work. In other cases the Bureau acts only as an agent in performing such engineering and construction supervision as may be requested for specific projects. In still other cases the Bureau's functions are limited to review and approval of the location, type, and design of the road, and to general supervision over the construction work.

The volume of highway work performed under direct supervision of the Bureau during the fiscal year 1952 is indicated by the following items and expenditures:

Forest highways	$13,728,649
Park roads and trails	3,658,840
Parkways	5,405,606
Forest development roads	1,925,433
Cooperative work, forest highways (contributions for local work)	851,077
Los Alamos road (Atomic Energy Commission)	18,079
Arco road (Atomic Energy Commission)	679,656
Roads, bridges, and trails in Alaska:	
Tongass forest highway	879,426
Turnagain Arm	888,926
Other highways	5,083,635
Bonneville transmission-line access road	180,180
Bureau of land management	130,294
Total	33,429,801

Forest highways

Forest highways are those highways within or adjacent to the National forests that are of primary importance to the State, counties, or nearby communities, and have been selected for inclusion in the designated forest highway system. The system is largely coincident with the Federal-aid and State highway systems, and a considerable mileage coincides with sections of the interstate system. The total forest highway system of 23,414 miles includes 12,345 miles in 12 States of the Western region and Alaska, and 11,069 miles in 26 States of the Eastern region and Puerto Rico.

The extensive needs for improvement on the forest highway system are largely reconstruction. Many sections were constructed some 20 or 30 years ago to standards satisfactory for that period. These are now obsolete for present-day traffic and long ago reached the end of their economic life. It is necessary to reconstruct these highways to standards comparable with those of connecting and adjacent interstate, State, and county improvements.

During the fiscal year, 353 miles were completed by the Bureau at a cost of $12,668,519 of which $11,618,206 was Federal funds. This is shown in table 17 of the appendix, which also gives corresponding figures for projects programed, authorized, and under construction at the close of the fiscal year.

Along with construction operations, surveys were conducted on an extensive mileage of roads, and plans and specifications were prepared. Plans were completed to fully absorb forest highway funds available for the next fiscal year. Some typical forest highway improvements are described below.

Yellowstone Trail.—The 84-mile Yellowstone Trail, Montana forest highway route 8, is a part of the primary State highway system of Montana and is on the National System of Interstate Highways. The route extends from Lookout Pass (elevation 4,738 feet), on the Idaho-Montana line, through mountainous terrain to a point near Missoula. Snowfall on Lookout Pass reaches a depth of 10 feet, but the route is the most important east-west transcontinental highway crossing the northern tier of States, and it is kept open for winter traffic. A 12-mile relocation completed during the year, eliminated a hazardous section of highway, known as the "Camel's Hump" that has been a source of nervous strain to tourists and a serious concern to State maintenance forces. Another 4.5-mile section was under construction. Over 2 miles of railroad track were to be moved to obtain a location meeting interstate highway system standards.

Pacific Highway.—Originally completed in 1923, the 11-mile Oregon forest highway route 15, which is on the interstate system in Oregon, has been one of the most substandard sections of the Pacific Highway (U S 99), which carries the bulk of north-south Pacific coast traffic. Reconstruction to modern standards adequate for the 4,000 vehicles using the route daily was coordinated with similar work by the State in the improvement of the Pacific Highway south from Eugene. Completion of the improvement of the forest highway route during the year was a major step in the improvement of the Pacific Highway in southern Oregon. The highway traverses rugged terrain and a third lane for the use of heavy vehicles on steep adverse grades, and four lanes over summits, were considered necessary. This construction proved very satisfactory in handling the mixed traffic using this route. Another unusual feature was the installation of 10 reinforced-concrete-arch culverts of 20-foot span with flared inlets. These are the largest culverts yet built with flared inlets. Application of this new flared inlet design to increase the capacity resulted in a saving in cost.

Alamogordo-Cloudcroft.—New Mexico forest highway route 35 is a section of one of the most important east-west highways in southern New Mexico. It connects U S highways 54 and 285. The 13-mile section has been under construction for the past 6 years. Passing through a high, scenic, mountainous country, the road serves an important recreational need and gives access to the most productive timber area in the State. It also serves a very productive fruit area in the vicinity of Cloudcroft. At one place on the route there is a 450-foot tunnel. Completion of 7½ miles of bituminous surfacing placed this highway in a much improved condition.

Moran-Yellowstone.—For many years Wyoming forest highway route 3, the 25-mile approach road to Yellowstone National Park from Moran, Wyo., has been a serious bottleneck for the heavy volume of seasonal traffic visiting Yellowstone and Grand Teton National Parks. Intensive construction efforts during the past few years have brought this road up to modern standards. It now constitutes one of the most scenic and comfortable drives in the National park area. During the 90-day park season it serves a volume of traffic of some 1,200 to 1,500 vehicles per day.

National park highways, park approach roads, and parkways

The Bureau cooperates with the National Park Service of the Department of the Interior in the improvement of highways within or approaching National parks and monuments, and parkways specifically designated by legislation. The Bureau collaborates with the Park Service in developing programs and its engineers make surveys, prepare plans, and supervise construction.

During the fiscal year, 103 miles of park highways and parkways were completed, and 199 miles were under construction at the end of the year. Typical improvements are described below.

North Entrance-Rio Grande, Big Bend National Park.—During the past 5 years some 18 miles of the approximately 140-mile primary road system in Big Bend National Park in Texas have been improved under Bureau supervision. This is a new park along the Rio Grande River in southwestern Texas and, for the most part, it has been served by very primitive roads and trails. This initial improvement primarily furnishes suitable access to the new Park Service headquarters and improves travel conditions to some of the scenic features. Much more road improvement is necessary to fully develop and serve the park area.

Baltimore-Washington Parkway.—The Federal Government is building as a parkway 18.5 miles—approximately half the total length—of a new highway from Baltimore to Washington. The Federal funds are administered cooperatively with the National Park Service.

Grading had been completed for 6 miles in previous years and an additional 3.5 miles were nearing completion. There were 12 bridges under construction, 3 of which were let to contract during the year.

The parkway was designed by the Bureau for safe and rapid movement of large numbers of vehicles through a pleasing roadside appropriate as an approach to the National Capital.

Blue Ridge Parkway.—The Blue Ridge Parkway in Virginia and North Carolina, some 478 miles in length, was started in 1935. Paving has been completed on 296 miles; stone or gravel base course has been completed on 14.7 miles; 2.5 miles have been bituminous surface-treated; 6.0 miles have been graded. Under construction or nearing completion were 5.0 miles of grading and base course and 49.0 miles of paving. Grading was still to be done on 131 miles. During the year a 21-mile section near the Peaks of Otter in Virginia was paved and a 6-mile section in North Carolina was graded and surfaced.

Natchez Trace Parkway.—The 450-mile Natchez Trace Parkway, located approximately on the historic route of the same name, extending through Tennessee, Alabama, and Mississippi, was begun in 1937.

Paving had been completed on 63 miles, 96 miles had been improved in some degree but not paved, and no work had yet been undertaken on 291 miles. During the year, 19 miles of paving were completed in Mississippi and 7 miles of grading were nearly completed.

Forest development roads and main roads through public lands

Forest development roads are the roads within the National forests that are of primary importance for the protection, administration, and integration of the forests. The Bureau, when requested, supervises their improvement. During the fiscal year, 12 miles were completed and 62 miles were placed under construction, including several major bridges.

Three miles of main road through public lands were completed with funds provided particularly for this class of work.

Access roads to defense establishments

Legislation of 1950, as amended in 1951, authorized $45 million for access roads to reservations of the armed forces, to defense industries, and to sources of raw materials. Legislation of 1952 authorized an additional $50 million for the same purposes. The law required that improvements undertaken be certified as important to the national defense by the Secretary of Defense or such other official as the President might designate.

By the end of the fiscal year, $26.5 million had been appropriated, all of which had been committed to specific projects by March 1952, except for a sum reserved for preliminary engineering and contingencies. At the end of the fiscal year, 97 certified projects had been completely financed, 4 projects had been partially financed, and preliminary engineering had been financed for 26 other certified projects. However, there was an accumulation of 41 certified projects estimated to cost $11,447,493 for which funds were not available. There were 43 additional projects proposed, for which investigation by the Bureau had disclosed apparent justification for improvement under the access-road program. These projects were being considered for certification by appropriate agencies. If certified, they would require $6,362,948. In addition, conditions at 131 defense installations were being investigated by the Bureau on specific request of certifying agencies which believed access-road deficiencies to be such as to warrant improvement.

All investigations of access-road deficiencies undertaken were initiated by formal requests of certifying agencies. Eligible roads are generally those needed to serve new defense traffic of temporary duration for the period of the emergency. The access-road funds are applied only on work that cannot be financed appropriately by regular Federal-aid and other funds.

Of 101 certified projects where construction work has been financed, 16 projects serve Army installations, 14 serve Navy installations, 15 serve Air Force installations. Atomic Energy Commission installations are served by 9 projects, 13 serve uranium mines, and 34 serve other mines producing critical and strategic minerals and metals such as tungsten, cobalt, and fluorspar.

The larger access-road projects are constructed by contract. For haul roads into many of the isolated mining areas, construction payments sometimes are made at an hourly rate for fully operated equipment such as bulldozers, tractors, and graders, or other units suitable to the construction requirements. This method has proved quite satisfactory in getting such roads constructed without delay, since it obviates surveys, preparation of plans, and other time-consuming preliminaries. Typical defense access projects are described below.

Blackbird Mine.—The Blackbird Mine access road in Custer and Lemhi Counties, Idaho, involves the improvement of 46 miles of road to the Blackbird Mine by widening to two lanes and surfacing with gravel. This mine is the only known workable deposit of cobalt in North America. Cobalt is important to the defense effort because of its use in electronics and in the manufacture of jet-propulsion engines and tools for cutting metal. The most powerful magnets are made from an alloy of cobalt, nickel, and aluminum. Construction of the road was well under way at the end of the year.

Meyers Cove-Simplot Mine.—Improvement of the Meyers Cove-Simplot Mine road in Lemhi County, Idaho, involves the widening and gravel surfacing of 16 miles of an inadequate single-lane road. This mine has an order for 30,000 tons of fluorspar concentrate from the emergency procurement service of the General Services Administration. This mineral is used as a flux. The road was about 35 percent complete at the end of the year.

Construction in Alaska

The Bureau, in cooperation with the Alaska Road Commission of the Department of the Interior, has been constructing a system of modern highways in Alaska since 1948. This system, when completed, will connect Fairbanks in the interior of Alaska with seaports and the Canadian highway system.

The major portion of the work has been financed with Department of Interior funds. Part has been performed by the Alaska Road Commission either by contract or by its own forces. At the request of the Alaska Road Commission, however, most of the engineering and construction supervision has been done by the Bureau. A portion of the construction is on the highway system in the National forests and is performed by the Bureau using regular and special forest highway funds.

Construction of the Turnagain Arm section of the Seward-Anchorage highway was started in 1948 under an agreement with the Alaska Road Commission. Contracts for grading and drainage structures were awarded in the amount of $7,194,658, and the entire 47 miles of construction were completed in the 1950 and 1951 construction seasons. A contract was awarded late in 1951 for bituminous paving of a 33-mile section at a cost of $1,027,144. Completion was scheduled for the fall of 1952.

A 55-mile section of the highway from Seward is being constructed by the Bureau at the request of the Alaska Road Commission under an appropriation of $7.5 million for this purpose. Contract work totaling $6,358,000 is under way. Construction was originally scheduled for completion in the calendar year 1951, but unusually adverse weather retarded the work. At the end of the fiscal year the work was 90 percent complete. Following completion of the grading work, a contract is to be let for bituminous paving. This work is scheduled for completion in 1953, at which time the entire 130-mile length of the highway from Seward to Anchorage is expected to be completed.

The extensive program of road improvements in the interior of Alaska was being continued by the Bureau under agreements with the Alaska Road Commission. The work included survey, design, and preparation of plans for 613 miles of highway, and supervision of reconstruction and bituminous surfacing of 301 miles of the Glenn, Richardson, and Alaska Highways. Work has been completed on 212 miles at a final cost of $9,042,611. A 52-mile section of the Alaska Highway was being surfaced with bituminous material and was 40 percent complete at the end of the fiscal year. The contract amount for this work is $1,884,391. Reconstruction of a section of the Richardson Highway, involving 38 miles of grading and 21 miles of bituminous paving, was under contract for $1,771,091 and was 50 percent complete. Both of these projects were scheduled for completion before the end of the 1952 construction season.

Plans and specifications were being prepared for the remaining 94 miles of the Alaska Highway in Alaska that had not previously been given a bituminous surface.

The total amount of contracts awarded to the end of the fiscal year on the Seward-Anchorage highway and for work in interior Alaska was $26,967,431.

A separate authorization in 1950 legislation made available $7 million for survey, construction, reconstruction, and maintenance of specific projects in and adjacent to the Tongass National Forest in southeastern Alaska. The growth of a wood pulp industry in the area made this work necessary.

A contract in the amount of $1,939,350 for reconstruction of 7 miles of the Tongass Highway at Ketchikan was awarded late in 1951, and at the close of this fiscal year work was 40 percent complete This is the largest contract involved in the improvement of the highway system in the area.

Two projects are under way in the Juneau area and one at Sitka. The work includes 5.6 miles of grading and drainage structures including one major structure and 5.2 miles of bituminous paving. These three projects are covered by contracts aggregating $1,338,892.

Access roads to lands supervised by the Department of the Interior

The Bureau prepared plans and was supervising construction of roads to serve areas in California and Oregon under the supervision of the Bureau of Land Management, Department of the Interior. A system of roads has been planned as a long-range development program to be financed through authorization of funds to the Department of the Interior. At the end of the year, work to cost $788,000 was under way.

Roads for the Atomic Energy Commission

The Bureau has entered into an agreement with the Atomic Energy Commission under which it is to make surveys, prepare plans, and supervise the construction of extensive highway improvement in connection with atomic energy development.

This work is financed with funds appropriated by Congress to the Atomic Energy Commission and transferred to the Bureau of Public Roads for individual projects. Active construction operations to cost $223,000 were under way.

Joint Planning of Location of Highways and Airports

Joint planning of the location of new airports and the expansion of existing ones, together with the planning of the location of the adjacent highways, has for several years been carried on by the the Bureau and the Civil Aeronautics Administration, aided by the highway departments and aeronautic commissions of the States. The results have been gratifying.

This activity began in compliance with the requirements of the Federal-aid Highway Act of 1944. Under the terms of this act, Federal funds may be used for the reconstruction or relocation of highways on the Federal-aid systems which give access to airports, provided the Bureau and the State highway departments have concurred with officials in charge of the airport that the proposed airport and highway improvements are in the public interest.

A principal purpose is the avoidance of waste of funds for highway and airport construction arising from a failure to anticipate the effect of the location of each upon the other.

The importance of assuring minimum safety standards of airport approaches was emphasized in the recent report of the President's Airport Commission, *The Airport and its Neighbors.* The Bureau of Public Roads has been fully aware of the problem as it affects highways, and has been diligent in its efforts to promulgate suitable minimum design standards—applicable both to the highway and the airport—and in enforcing such requirements.

The Bureau and the Civil Aeronautics Administration are conducting joint studies to ascertain the adequacy of existing highway facilities between the business districts of major cities and the airports serving those cities, as well as to determine the measures which can be taken to accelerate the movement of vehicular traffic between those termini if the studies indicate that existing highway facilities are inadequate.

Aerial Survey for Mississippi River Parkway

The Bureau, in cooperation with the National Park Service of the Department of the Interior, completed a study and reported to Congress on the feasibility

of a parkway along the Mississippi River from its headwaters to the Gulf of Mexico. Such study and report was directed by legislation approved August 24, 1949, which appropriated $250,000 for the purpose.

The survey was notable because of the complexity of the problem presented. Selection of alternative routes required a detailed knowledge of a band of topography 15 to more than 25 miles wide on each side of the river for a distance of 2,552 miles. Data had to be obtained on every factor affecting the location of a parkway such as topography, scenic views, historic spots, locations of cities, towns, and villages, agricultural development, stream crossings, existing highways, soil conditions, road materials, and location of levees.

With nearly 10,000 miles of feasible alternate routes to be examined within a short time and permissible expenditure limited to $25 per mile, it was decided to use aerial photography, the most modern method of highway reconnaissance. Over 22,000 aerial photographs were taken. With these photographs in hand, the possible routes were examined in the field by engineers and other parkway planners. Notes were taken to supplement the information on the photographs.

Examination of the photographs in the office with a stereoscope and other equipment gave to the engineers a view of each mile as good as would have been obtained had they had a magic carpet on which to travel and which could be made to hover over any selected spot. There was the important advantage that distances, elevations, and grades could be determined with acceptable accuracy. Examination of pairs of pictures with a stereoscope is much superior to study of the ordinary single picture since elevations and depressions stand out as clearly as they do when one looks at a landscape. It was possible to locate routes on the photographs and make preliminary estimates of cost with an expenditure of time and money far below that necessary had older methods been used.

There are many highway projects where use of aerial-survey methods in making preliminary surveys will give superior results and make possible large savings over the older ground-survey methods. Aerial surveys do not obviate the necessity for a final ground survey but they greatly simplify the steps leading up to it. Use of aerial surveys has been growing and should continue to increase in the future.

The report to Congress on a Mississippi River Parkway discussed a number of alternative routes. The estimated cost of a parkway throughout the length of the river, whether on its east or west bank south of St. Paul, was $770 million. An estimate was also made of the cost of each of two routes which would utilize the better parts of existing highways joined by sections on new location. A 2,000-mile parkway on one of these routes was estimated to cost $560 million. It contained about 60 percent of existing roads, 1,000 miles of which were on the Federal-aid primary highway system, about 250 miles not on the system, the remainder to be on new location. A 1,970-mile parkway on the other of these routes was estimated to cost $510 million. It contained about 75 percent of existing roads, 1,200 miles of which were on the Federal-aid primary highway system, about 250 miles not on the system, the remainder to be on new location.

Under the recommended plan, the route for the parkway would be selected cooperatively by the States along the river. Such a route would utilize existing highways wherever they are in satisfactory position. Connecting sections on new location would be selected at places where marked improvement could be obtained with better possibilities of parkway development, including greater scenic and historic interest, and recreational possibilities. The development of the project would be undertaken by the highway departments within the framework of the present Federal Highway Act with certain additions designed to accomplish a parkway development.

Repair of War-Damaged Highways

Activity in connection with the repair of war-damaged roads, as authorized by the Defense Highway Act of 1941, was largely completed in previous years. A total of 294 claims for the repair of 6,254 miles of roads, in the amount of $10,717,896 have been approved, funds appropriated, and payment made. The payment of these last claims completed the activity resulting from World War II.

Public Law 177, approved October 16, 1951, authorized expenditures of defense access-road funds for road reconstruction, maintenance, and repair in certified maneuver areas. No claims under that act were received.

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 relief 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 highway systems. The legislation of 1952 established a revolving fund of $10 million annually for this purpose.

Allocations of emergency relief funds totaling $5,022,681 were made during the fiscal year to six States, to assist in rehabilitation work estimated to cost $10 million. Of the total amount of emergency relief funds allocated, $4,666,800 was for the repair of flood damages that occurred during June and July 1951 in Kansas. Minnesota, Missouri, North Dakota, and West Virginia received the major portion of the remaining $355,881 of emergency relief funds allocated during the fiscal year.

During the latter part of the fiscal year, disastrous floods occurred in five of the Midwestern States and in Montana and Utah. Six of these States have notified the Bureau of their intention to request allocations of emergency relief funds, and steps were taken to cooperate on rehabilitation work.

Hawaii War and Emergency Damage Program

A Federal fund of $10 million was authorized in 1947 for rehabilitation or repair of roads and bridges in Hawaii damaged by the armed services or by their contractors, and for the restoration or reconstruction of highways and bridges damaged or destroyed by seismic waves in April 1946.

The Territory was required to match Federal funds to the extent required by the Commissioner of Public Roads. On work resulting from damage caused by the seismic wave, the Territory has been required to make a contribution equal to that of the Federal Government.

By the end of the fiscal year, programs had been approved for war-damaged highways costing $3,416,560 in Federal funds and for seismic wave-damaged highways costing $6,393,745 in Federal funds. The total cost of the work, including matching funds, was $16,764,683 which provided for rehabilitation or repair of 270 miles of roadway and bridges.

The program was in its last stage. Completed projects totaled 257 miles, of which 7 miles were completed during the year. Five miles were under construction and 8 miles were still to be placed under construction.

The Inter-American Highway

The Inter-American Highway is that section of the Pan American Highway which extends from Nuevo Laredo on our Mexican border to Panama City, a distance of approximately 3,200 miles.

Since 1930 the United States, through the Bureau of Public Roads, has been assisting the Republics of Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica, and Panama in the construction of the Inter-American Highway. The section of the highway in Mexico has been financed and constructed entirely by Mexico.

The Inter-American Highway still is not passable over its entire length. In Mexico it is open and in excellent condition over the entire distance to Guatemala, but in Guatemala, beginning at the Mexican border, there is an impassable gap of 25 miles. In northern Costa Rica there is also a gap of about 65 miles, and in southern Costa Rica and western Panama there is another gap of about 150 miles, both of which are impassable. Among the passable sections are many which still need further improvement because of inadequate surfaces, sharp turns, steep grades, and narrow roadway. On the other hand, there are also many miles of excellent modern highway. Sixty-five percent of the highway is paved. Another 28 percent is passable at all times, and only 7 percent of it is impassable at all times.

During the fiscal year, the United States provided an additional $3 million for the continuation of cooperation with the Central American republics in constructing the highway.

During the previous year, basic agreements covering matters made mandatory by legislation were entered into with El Salvador, Nicaragua, Costa Rica, and Panama. Conditions have prevented such agreements with Guatemala and Honduras.

In general, the construction on the Inter-American Highway was accelerated during the past year and plans are being made for a larger construction program in the future.

In Guatemala, it was necessary for the Bureau to abandon the work and remove its offices and personnel.

In El Salvador, all the necessary agreements have been made to complete the Inter-American Highway.

No work was done in Honduras during the fiscal year.

In Nicaragua, construction was started on the most important bridges between Esteli and the Honduras border. Orders have been placed for the structural steel and surveys and bridge plans made.

The greatest progress was made in Costa Rica. The work in that country is being done by the Bureau. Costa Rica is supplying $900,000 of their own funds on a project estimated to cost about $3 million. During the year, about 30 miles of all-weather road were constructed just south of Las Canas and additional improvement has been made on the sections between San Ramon and Esparta and between Cartago and San Isidro.

In Panama, work has been underway on about 25 miles of all-weather road including five major bridges. This work is being done by a Panamanian contractor. In Central America, highway work is almost universally performed by the local governments with their own equipment and labor. The section of highway in Panama is the first that has been let to contract on a fixed-unit-price basis under competitive bidding. It is hoped that additional work can be done under this system.

Projects other than the Inter-American Highway

The Bureau has continued its technical assistance to El Salvador in construction of a bridge over the Lempa River at San Marcos. The bridge is nearing completion.

At the request of Honduras and Nicaragua, the Bureau continued its technical assistance in planning and constructing their national highway systems.

In Ecuador, assistance was continued in the construction of a highway from Manta to Quevedo which will form a link in connecting the capital with the new port of Manta.

Aid to Turkey in Highway Improvement

Highway aid to Turkey is administered through a division office in Ankara and was initiated in 1947 following a request by the Turkish Government and formal agreements executed in 1947 and 1948 between that government and the United States.

Funds for supplying equipment and technical assistance have been provided, first by allocation of $5 million under Public Law No. 75, Eightieth Congress, and later by Economic Cooperation Administration loans totaling $18.5 million. A recently approved loan of $3.5 million by the Mutual Security Agency brings the total amount that has been made available for equipment and assistance to $22 million. Funds for the operation of the equipment and for all other highway activities are provided by the Turkish Government. Expenditure of Turkish funds during the fiscal year ending March 1, 1952, amounted to the equivalent of $30.5 million. Delivery in Turkey of highway equipment and tools now amounts to 21,120 tons valued at $16.6 million.

Personnel training, an essential activity at the beginning of the program, remained undiminished in importance. However, with the arrival of construction machinery in substantial quantities, personnel training shared attention with operational activities such as the survey, design, construction, and maintenance of highways and the establishment and management of equipment repair shops. Methods of personnel training were changed, principally by substitution of on-the-job methods for theoretical classroom instruction. At the close of the fiscal year, 2,116 persons had received instruction in formal courses.

The organization and management of highway survey and design activities have been improved as the Turkish engineers have gained experience in the application of modern methods. An average of 37 location survey parties were in the field during the year with work concentrated in southern areas during winter months. Eighteen hundred miles of location survey were completed during the fiscal year, bringing the total since the beginning of the program to 4,800 miles. Design and plans for 3,000 miles of highway have been completed, of which 1,600 miles were produced in the past year.

Continued progress in equipping and training Turkish construction and maintenance forces is reflected in the increasing mileage of national highway that has undergone major improvement or has been placed under machine maintenance. At the end of the fiscal year approximately 11,250 miles were being maintained by machine methods, and the remaining 3,950 miles of the designated system either were being maintained by hand labor or were ungraded trails used by pack animals and animal-drawn vehicles. Construction forces improved 837 miles of highway by grading and gravel surfacing, 560 miles by gravel resurfacing, and laid 176 miles of asphalt surface during the year.

Gratifying results continue to attend the efforts to encourage a highway contracting industry and thus obtain the advantages of competitive bidding and efficient management. During the year 175 miles of highway were constructed

by contract. Contracts were in force at the close of the year for construction of 324 miles.

Improvements to main routes of the National Highway System have resulted in wider distribution of goods and in bringing production centers closer to consumers. Savings in transportation cost have had an inevitable effect on the cost of commodities. Improved transport has greatly increased the potential strength of the country for defense. Lowered bus operating costs resulting from highway improvements have brought about a marked increase in the social and recreational travel of a people inherently partial to mobility. Registration of motor vehicles increased 124 percent from 1947 to the end of 1951.

Illustrative of the economically favorable changes in transportation costs and in travel time that have occurred in the past three years, and that properly may be attributed to the improvement in highway facilities effected during that period, are the following examples for routes radiating from Ankara. Istanbul, Kayseri, and Zonguldak are now reached from Ankara in slightly more than half the time formerly required. Freight rates have been reduced by 71, 38, and 66 percent, respectively, and passenger rates by 40, 17, and 46 percent.

Turkish officials express a high regard for the equipment and methods introduced.

Other Foreign Activities

Ethiopia

During the previous fiscal year an advisory mission of Bureau technical personnel arrived in Ethiopia to supervise equipping, training, and organizing an Ethiopian Imperial Highway Authority and assisted it in the work of restoring the highway system.

During the year considerable progress was made in advancing the program. Equipment and personnel were provided in quantity sufficient to complete approximately 20 percent of the contemplated initial program. All of the principal highways were reopened to traffic. Previously they were impassable except for a few months of the dry season when travel was possible though with difficulty and numerous delays. Traffic increased in volume and travel time decreased generally.

Efforts were directed mainly to establishment of staff and working procedures, acquisition of equipment and its placement on jobs, so as to open all main roads to travel for their entire length. When the roads were opened, attention was turned to placement of additional surfacing and base course material, and patching of the bituminous surfacing where it could be salvaged in order to further improve the facility of transport. Plans were made for improvement of a system of roads reaching out into areas of great agricultural potential. There are a number of areas of great promise that have not been developed because the only transport available has been by pack animals over trails.

As a result of the program, products began to move over highways in greater volume and areas were being put into agricultural production where formerly there was no activity because of inaccessibility.

Liberia

A program of economic development in the Republic of Liberia, with assistance from the United States, progressed to the action stage. Cooperation under the Point Four program is administered by a Joint Liberian-United States Commission for Economic Development. The Bureau is acting in an advisory capacity to the Transportation Section of the Liberian Department of Public Works. The Bureau also acts as consultant to the Export-Import Bank of Washington in administering a $5 million loan for highway development.

Liberia earmarked approximately $263,000 for highways in 1952. The United States budgeted $36,956 during fiscal year 1952 and $207,414 has been requested for the fiscal year 1953 for highways. Under Point Four policy practically all of the United States funds are for salaries and expenses of personnel. Three engineers and two equipment specialists arrived in Liberia between January and July 1952.

Liberia has one principal highway through the country, approximately 300 miles in length, from its only modern deep-water port at Monrovia to the French Guinea border, and a number of widely scattered and for the most part unconnected short sections of unimproved roads. The Government has no highway department. All road work, chiefly maintenance, is supervised by the chief engineer of the Department of Public Works and Utilities, with a very few assistants.

Two short location surveys were made and plans prepared. A highway program, which includes 371 miles of location surveys, 193 miles of construction, and replacement of small bridges, has been prepared and submitted to the Export-Import Bank. It is planned to purchase construction equipment, and to construct and equip a modern equipment depot and highway office comparable to that of a small State highway department.

Liberia plans to contribute $1,325,960 of current revenues to the program. It is estimated that completion of this initial program will require about three years, during which time on-the-job training of Liberian students will be given special attention.

Philippine highways

The program of rehabilitation of war-damaged bridges and highways in the Philippines has been brought to a conclusion. This program was authorized by the Philippine Rehabilitation Act of 1946, and $39,488,455 was provided for work to be done in cooperation with the Philippine Government.

The entire program resulted in the construction or repair of 263 major bridges, construction of 384 miles of roads and streets, procurement from the United States of large quantities of supplies and equipment, special training of 238 Filipino engineers, establishment of a materials laboratory, and development of a plan for future highway improvement.

At the beginning of the fiscal year, only 70 projects remained uncompleted, and they were substantially completed at the end of the year. Some work remained to be done on 10 projects. The Philippine Government will undertake completion of these.

The work completed has been of great value in the economic recovery of the islands. Highway transport has been increased enormously. The stimulation of highway use and the training in highway work will undoubtedly yield dividends in the period ahead.

Last year it was reported that the Bureau had accepted responsibility for a Philippine highway development program under the auspices of the Economic Cooperation Administration, and that $3 million had been set aside for construction of roads in backward areas. During the year this work was placed under the general direction of the Mutual Security Agency and the allocation increased to $5,990,000. A staff of 10 or 15 Bureau men will remain in the islands to assist in carrying on the work.

Point Four program

Assignment of technical personnel of the Bureau to assist in the work of the Technical Cooperation Administration (Point Four program) was discussed with interested officials. This program is aimed particularly at agricultural development. In practically every country highway improvement is a prerequisite to

greater production of either goods or crops. Production is of little value where there is great difficulty in distribution. Preliminary study was made in Iraq and in Trans-Jordan. There was discussion of proposed operations in India, Pakistan, Israel, Iran, Paraguay, Peru, Cuba, and Colombia.

Foreign Visitors

During the year, over 220 engineers from more than 54 countries came to the Bureau for assistance in studying American highway practice. The third annual course on the theory and practice of highway improvement and utilization in the United States, begun in the previous fiscal year, was completed on September 7, 1951, with participation of 49 delegates from 26 countries. The fourth annual course started on May 19, 1952, with 44 delegates from 27 countries and will be completed on September 5, 1952. These courses provide a program of 16 weeks duration of which 8 weeks are devoted to study and observation of construction and maintenance practices in the field, and 8 weeks to study and discussion in Washington.

Included among the delegates to the 1952 course were eight who received grants under the Point Four program; eleven were sponsored by the Mutual Security Agency; two had United Nations fellowships; and one was a grantee under Public Law No. 265. The remaining 22 delegates were sponsored by their own governments.

During the year, 12-month training programs begun in the previous fiscal year were completed for a group of 24 Turkish engineers under the sponsorship of the Economic Cooperation Administration (now Mutual Security Agency). A new Mutual Security Agency training project including 20 Turkish engineers for a 9-month period, was started during the year.

A short, intensive program of training and observation for a group of 13 French engineers, lasting approximately 7 weeks, was carried out following completion of the 1951 highway course. This group was also sponsored by the Mutual Security Agency.

Additional formal programs of study were provided for four recipients of Point Four grants, one Mutual Security Agency sponsored trainee, and one under a United Nations fellowship. Altogether, programs of study, observation, and work for periods of time from 6 or 7 weeks to a full year were arranged for a total of 156 foreign nationals. In addition to the formal programs of instruction and training, 65 engineers from other countries were assisted for periods of time ranging from an hour or two, up to about 6 months.

Cooperation of the various State highway departments in providing opportunities for observation, study, and actual work has contributed greatly to the value of the program.

Calendar of Courses of Instruction in Highway Engineering

Throughout the period of modern highway development, methods, procedures, and techniques have been developed that were entirely new to most engineers busy with their regular work of construction and maintenance. Highway magazines and papers presented at society meetings have been helpful in keeping them posted, but actual training by experts, in particular fields, is by far the best method of introducing new methods and practices. Subjects in which there has been special need for training include soil science, aerial surveying, traffic surveys, and highway drainage. The Bureau has been active in conducting training courses for engineers of highway organizations of the United States and other countries, as indicated by the following tabulation.

July 1–June 30.—The Bureau continued its program of recruitment of selected young engineers, giving them 3 years of instruction in highway engineering and administration through on-the-job training after which they will be placed in regular positions. During the year 26 young engineers were appointed. They reported to field offices and were assigned to survey, design, and construction work for the entire year. Other trainees appointed in the two preceding fiscal years were receiving instruction in Washington and in the field.

July 1–September 7.—Completed general training course begun on May 21, 1951. Field trips and instruction in Washington. Attended by 49 delegates from 26 countries.

September 10–October 10.—General training course for 4 Colombian engineers.

September 20–21.—Course in development of facts for use in highway planning at meeting of Western Association of State Highway Officials in San Francisco, Calif. Attended by highway officials of 11 western States.

October 3–5.—Course in highway drainage at St. Paul, Minn. Attended by 34 engineers of the Bureau and State highway departments of Minnesota, Iowa, and Nebraska.

October 8–November 21.—General training course in Washington for 13 French engineers sponsored by Mutual Security Agency.

November 13–15.—Course in highway drainage at Wisconsin Rapids, Wis. Attended by 20 State and Bureau engineers.

December 12–14.—Course in highway drainage at Pierre, S. Dak. Attended by 56 State and Bureau engineers.

January 14–18.—Course in highway drainage at Madison, Wis. Attended by 9 Bureau engineers.

January 27 and 30.—Course in estimating probable traffic on proposed expressways at traffic engineering conference of University of California at Berkeley and Los Angeles, Calif. Attended by traffic engineers of California and adjacent States.

February 5–7.—Course in highway drainage at Bismarck, N. Dak. Attended by 29 engineers of various highway agencies.

March 20–21.—Course in development of highway safety programs as part of Michigan highway safety seminar at Lansing, Mich. Attended by State, county, and city highway officials.

April 1–3.—Course in weighing vehicles in motion with electronic equipment as part of Ohio highway engineering conference at Columbus, Ohio, sponsored by University of Ohio and Ohio State Highway Department. Attended by State, county, and city highway officials.

April 16–18.—Course in determination of highway capacity as part of University of Tennessee highway conference at Knoxville, Tenn. Attended by State, county, and city highway officials.

May 19–June 30.—Started general training course to continue to September 5, 1952. Field trips and instruction in Washington. Attended by 45 delegates from 27 countries.

June 2–6.—Course in aerial survey methods at Raleigh, N. C. Attended by 34 State and Bureau engineers.

At various times individual instruction was given in aerial survey methods to 33 engineers for periods ranging from 1 to 20 days.

Individual training programs in the field and in Washington for 39

Turkish engineers sponsored by Mutual Security Agency. For most of the engineers the training period was 1 year and was partly in the preceding fiscal year.

The President's Highway Safety Conference

The deaths, injuries, and great property damage resulting from motor-vehicle travel continued to be a big problem for all who design, build, and regulate the use of highways. Safety was a primary consideration in the location and design of every Federal-aid project. Much Bureau research was directed to determination of facts to be applied in making all new highways as safe as it is possible to make them.

There are many other aspects of the safety problem and the Bureau was required by legislation "to assist in carrying out the action program of the President's Highway Safety Conference and to cooperate with the State highway departments and other agencies in this program to advance the cause of safety on the streets and highways." The Secretary of Commerce became general chairman of the conference and the Commissioner of Public Roads served as chairman of the conference program and planning committee.

The Bureau entered into cooperative agreements with four national organizations for work in furtherance of the conference action program.

The State and Local Officials National Highway Safety Committee agreed to conduct an extensive program for coordinating and promoting highway safety activities among States and communities; to cooperate with the Governors' Conference in its program of highway transport; to assist in expediting highway movements, particularly those relating to the defense effort; and to determine the need for new traffic-safety legislation.

The National Academy of Sciences undertook to develop a national program for highway safety research and for the coordination of the work of research agencies in this program.

The American Bar Association undertook furtherance of traffic court improvement phases of the action program and to develop an authoritative guide for the organization of a system of State-wide courts, particularly rural courts, for handling traffic cases more effectively.

The American Association of Motor Vehicle Administrators agreed to promote adoption by the States of sound policies and procedures in motor-vehicle administration, with special attention given to driver licensing, vehicle inspection, and other regulatory measures affecting highway safety.

The conference prepared for a tremendous step-up in the entire safety program. Motor-vehicle travel increased about 25 percent in 3 years without a corresponding increase in traffic-accident prevention. Traffic fatalities declined after 1946 to a postwar low of 31,700 in 1949, then rose sharply to 37,300 in 1951, and were continuing the upward trend as the fiscal year ended.

More intensive safety activity was to be launched at a fall meeting in Chicago of State and local government representatives and public-support groups.

Financial and Administrative Research

Work under this general heading includes studies of highway costs, administration and management, land acquisition, highway access and roadside control, terminal facilities, finance and taxation, and allied economic problems. During the past year progress was made in all of these fields of study.

Administrative studies

A considerable amount of work in the administrative field was carried on in cooperation with the Committee on Highway Organization and Administration of the Highway Research Board. Reports on retirement provisions in State highway employment, on merit system provisions in State highway employment, and on State highway administrative bodies were completed and published by the Highway Research Board. During the year emphasis in cooperative administrative research was shifted from the State to the local level. Local road research undertaken was largely exploratory, but a comprehensive check list of items to be considered in making studies of local road management was completed.

A study of intergovernmental relations in highway affairs in Maryland was completed. This was a cooperative undertaking of the Highway Research Board, the Bureau of Public Roads, the Maryland Commission on Administrative Organization of the State, and the Maryland State Roads Commission. The purpose was to describe existing highway relations in the State, both State-local and interlocal, to make recommendations for improving these relations, and to set up criteria for good relations.

Work on a study of statutory provisions affecting State-local highway relations in all States was continued. In connection with this study, since the fiscal relation is in all cases a basic one, data concerning the imposition and distribution of motor-user taxes were tabulated.

The study of administrative practices in motor-vehicle regulation was also continued. A previously compiled tabulation of penalty provisions for violations of truck weight and size limitations, including complementary enforcement provisions, was revised to include pertinent 1951 legislative changes.

Tables showing the directing organizations of State highway departments and salary ranges of the principal officials were revised to show the status of this information as of December 1951.

Financial studies

Highway finance data for counties and municipalities now are being reported by almost all States: 47 of them are reporting county data and 46 are reporting urban data. The reporting procedures of the States are constantly improving, and the data are being reported on a more current basis each year. The scope of the studies of urban street finance has been increased to include data pertinent to the so-called "allied functions," i. e., storm sewers, street cleaning, street lighting, parking meters, and publicly owned parking lots.

A report on the credit financing of highways was prepared in cooperation with the Highway Research Board. This report reviews the whole field of the credit financing of highways, with emphasis on the postwar period, and cites numerous recent examples of such financing.

Taxation studies

In cooperation with the Highway Research Board Committee on Highway Taxation and Finance, a comprehensive study of the problems of highway taxation was begun. The problems to be studied include: (1) an analysis of methods and bases of taxation for the support of highways, (2) the extent to which highway revenues should be obtained from motor-vehicle and non-motor-vehicle tax sources, and (3) the equitable allocation of motor-vehicle tax responsibility among vehicles of different types and sizes. Projects now under way include: (1) a study of the variation of charges on highway-toll facilities with size of vehicle, (2) a study of the diesel-powered vehicle in relation to the gasoline-powered vehicle in its payment of user taxation, (3) a compilation and

analysis of the State road-user taxes and personal-property taxes that would be paid in each State by a series of selected vehicles varying in size and weight, and (4) a study of the incremental method of motor-vehicle tax allocation.

Highway cost studies

The pilot study of the relation between road costs and roadway adequacy was continued. This study of a 210-mile section of U S 60 is being conducted in cooperation with the Kentucky Department of Highways. In addition, the annual costs on 96 control sections in eight States were determined. These data were prepared as a part of studies in an endeavor to determine the effects of truck traffic and weights on highways. Tests of annual road cost reliability were conducted in cooperation with the Maine and Mississippi highway departments.

Assistance in summarizing and analyzing information on street construction and retirements was given Milwaukee, Wis. The Milwaukee project, a cooperative undertaking between the city, the Wisconsin Highway Commission, and the Bureau, is expected to yield authoritative information on the service lives of city streets. Basic records prepared for this study have made detailed information about the street network conveniently accessible.

Assistance in preparing estimates of the cost of remedying existing highway needs was given New Mexico and North Dakota. In addition, a plan was devised in cooperation with the North Dakota Highway Department which will permit the State to bring its inventory of needs up to date periodically with a minimum of effort.

On a broader scale, assistance was given the American Association of State Highway Officials in compiling an estimate of needs for each of the Federal-aid highway systems. This summary brings up to date an estimate developed two years earlier.

Of general interest to all State highway departments was an article describing the procedures involved in establishing permanent highway control sections and outlining the ways in which information collected on a control section basis is used. Aid in establishing control sections was given New York.

In cooperation with committees of the American Association of State Highway Officials and the Highway Research Board, assistance was given in bringing to light the advantageous applications of, and the limitations upon, the use of highway sufficiency ratings.

Production cost studies

The purpose of all production cost studies is reduction of unit costs in highway work. One method of attaining this objective is through increased efficiency of construction and maintenance operations. Work in this field consists largely of time studies of equipment and labor performance on numerous construction and maintenance operations, in seeking those delays that may be eliminated or operating procedures that should be changed, thus increasing efficiency and ultimately lowering costs.

Studies of equipment performance were conducted on 25 construction jobs throughout the country. The comprehensive study of maintenance equipment utilization and performance in Connecticut was concluded. Studies of maintenance equipment utilization and performance on State highway work were conducted in five States.

Cost studies were started on five North Carolina construction projects with the objective of developing comparative data regarding net cost to the public of construction work performed by contract and by State forces under conditions prevailing in North Carolina. The projects selected for study involve reconstruction of typical farm-to-market roads. These projects are part of a

larger group proposed for reconstruction with Federal-aid funds by State forces, and the extent of Federal-aid participation in the proposed program will be influenced by the comparative data developed from these studies.

Land acquisition, roadside control, and terminal facility studies

Research concerning legal and administrative phases of land acquisition, roadside protection, control of access, and parking facilities fills an important need in connection with the highway program. Studies in these fields were continued during the year, independently and in cooperation with State highway departments and national organizations.

The need for a workable method by which land adjoining present State highways can be reserved for right-of-way purposes, prior to outright acquisition, is apparent. Often it has been necessary to relocate highways no longer adequate to serve traffic needs, because additional land at the old location could not be purchased, due to exorbitant costs resulting from unrestricted ribbon development. A study of procedures available for reserving land, undertaken in cooperation with the Highway Research Board, continued during the year. Analysis of questionnaire returns from cities and counties known to have authority to use various methods for accomplishing this purpose revealed that such methods have been used sparingly, if at all. None of the procedures used seem to provide the answer. The second phase of the study, an analysis of techniques authorized or in use at the State level, was initiated during the year.

In order to obtain up-to-date information on existing toll-free expressways, heretofore lacking, a questionnaire was distributed to the State highway departments during the year. Returns from most of the States were received, and data pertaining to mileage, type of facility, cost, administrative problems, etc., were being tabulated for all expressways now open to traffic or under construction, not only on the Federal-aid primary highway system but also those on State, county, and city systems. The resulting compilations should constitute a gage by which to measure the progress of the expressway program.

A report dealing with highway right-of-way appraisals was undertaken during the year, in cooperation with a committee of the American Association of State Highway Officials, based on information obtained from the States on State land-acquisition practices.

The research and analysis covering all legislation dealing with the provision of parking facilities enacted up to and including 1950 were completed. It was found that a total of 266 laws have been enacted in 43 States and the District of Columbia, of which 106 are general in character, applying to all cities, towns, villages, or other political subdivisions in a given class or classes, and 160 are local or special in character, applying only to specific places or projects. A summary of the outstanding trends in this State legislation was prepared. A detailed report dealing with the provisions of the 266 laws will be made. This report will revise and supplement a similar report published in 1947, covering parking legislation through 1945.

A study was prepared on parking "systems," a concept which envisages the integration of off-street and curb parking facilities into a single system, both functionally, administratively, and financially. The legal provisions for the establishment of parking systems and the judicial decisions upholding the system idea were analyzed, and accomplishments under this method of establishing and financing parking facilities were summarized.

A preliminary report dealing with the effectiveness of various types of parking agencies in providing parking facilities was prepared, based upon returns to a questionnaire directed to each city known to have a parking board, commission, committee, authority, or other agency authorized to provide or foster the pro-

vision of off-street parking facilities. The purpose of this study is to bring together as much experience as possible in the use of parking agencies as a means of establishing parking facilities and to appraise the effectiveness of this approach to a solution of the parking problem. A more comprehensive report is contemplated, based upon fuller returns to the questionnaire.

Continued assistance in the legal, financial, and administrative phases of parking surveys was rendered to cities where parking surveys were under way. It is desired that this important aspect of parking surveys be given greater emphasis in the future, to the end that the needs determined by the parking survey may be implemented by the proper legal, administrative, and financial tools.

A project designed to collect information on parking meter installations and revenues, their operation, maintenance, and legal authorization, has been undertaken as a joint project of the Highway Research Board, the American Municipal Association, and the Bureau. Information is being solicited by means of a questionnaire directed to approximately 2,800 cities and other places. The data collected will be summarized and a report made on the findings.

Highway Transport Research

Research on many phases of highway transport is conducted by the headquarters organization of the Bureau and also in cooperation with the States as Federal-aid projects. A large portion of the work at headquarters is based on data supplied by the States.

Motor-vehicle-use studies

A new series of motor-vehicle-use studies was inaugurated shortly before the close of the previous fiscal year. These studies, State-wide in scope, are designed to classify motor-vehicle travel with respect to rural and urban ownership of vehicles, proportion of travel in rural and urban locations, principal road systems used, together with pertinent characteristics of travel including purposes of travel and length of trips.

At the close of the fiscal year these studies were under way in twelve States and in the Territory of Hawaii, with the field work completed in seven States; the studies are definitely planned in nine additional States; and ten more States and one territory have indicated their intention to conduct studies.

Information available from preliminary analyses in three States shows the average length of passenger-car trips to be about 9 miles, with three-fifths of all passenger-car trips being under 5 miles. Of the total vehicle-miles of passenger-car travel performed on urban streets, approximately two-thirds results from trips wholly within the city or town. The percentage of purely local trips increases with size of city, being more than 80 percent for cities of more than 100,000 population, according to these early returns.

Road inventory and mapping

Inventory operations in 42 States produced data concerning the degree of improvement of individual rural road sections that are being used in studies of highway deficiencies and needs, as well as valuable statistical data of a more general nature for systems and areas. Based on this inventory, 366 county highway maps have been produced in 30 States.

Other mapping activities of cooperative planning surveys included the publication by the States of 21 State general highway maps, 18 State traffic maps, 431 county traffic maps, and 99 maps of incorporated places.

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The Department of Defense was furnished information as to the load-carrying capacity and vertical and horizontal clearance of all structures on the Federal-aid primary highway system and other important through routes.

Tourist studies

Since approximately three-fourths of all vacation travel is by automobile, the highways are important to vacationers and influence the business activity resulting therefrom. Tourist travel by automobile continues to increase, and more and more interest is being shown regarding this multi-billion dollar industry.

Reliable information regarding tourist travel and expenditure has been lacking in most States and tourist studies are needed to furnish the facts. Such studies indicate the volume of tourist traffic, where the tourist spends money, and how much he spends. They give an economic measure of the value of highways to a growing industry.

Cooperative tourist studies were completed in Pennsylvania, in Glacier National Park, in Crater Lake National Park, and in Oregon Caves National Monument during the past year. Surveys have been inaugurated in the Shenandoah and Yosemite National Parks and in Oklahoma and Kansas in 1952.

Traffic studies in cities

Each year additional cities have been added to the growing list of metropolitan areas in which origin and destination information and other essential facts concerning travel have been collected. Data collected in these studies are used in the location and design of highway improvements, and the result of their application is manifest in the new arterial routes either planned or already under construction in many urban areas.

Three metropolitan area transportation studies by the home-interview method were started during the fiscal year. This brings to 92 the total number of comprehensive studies undertaken since the first one was started in 1944. Abbreviated procedures are now being developed for bringing up to date the data collected in the earlier studies. Progress along this line has been achieved in Memphis, Tenn., Kansas City and St. Louis, Mo., and San Juan, Puerto Rico.

Continuing studies initiated in 1950 of traffic using superior arterial routes confirm the fact that at least half of the traffic chooses the route even though it may mean a greater travel distance and greater travel time than by less attractive and older streets. Where both time and distance are saved the choice of the superior arterial route is almost unanimous.

Truck weights

The importance of highway service is indicated in large degree by the total traffic carried and especially by the tonnage of goods transported by trucks, the frequency of these movements, and the size of loads carried. Each year, most States obtain information on truck transport by classifying all vehicles passing a considerable number of selected locations and weighing as many of the commercial vehicles as is feasible. During the fiscal year 45 States participated in this program. Many of them expanded their operations from summer months only to cover all seasons of the year. Comparison of data obtained with that of previous years permits the calculation of trends in vehicle loading and in frequencies of heavy loads. The seasonal data are needed in considering road damage when conditions such as rainfall and freezing and thawing are most unfavorable.

Preliminary analysis of 1951 reports indicates an increase in ton-miles of carried load of about 6 percent over that of 1950. This increase is considerably less than the increase of 10 percent for mileage traveled by all vehicles.

Road performance studies

The studies initiated in 1950 to evaluate the performance of selected sections of road, using as indicators road condition, usage, and costs, have continued and now include 76 miles of road of several types. Each test section is at least 1,000 feet in length. A considerable variation in highway design and age of pavement is represented in the 368 test sections.

A few sections were constructed as recently as 1951 but some construction in each year back to 1928 is represented. Traffic ranges from 610 to 16,447 vehicles per day.

Subgrade soil analyses have been completed for 153 of the sections and initial condition charts have been drafted for 204 sections. Roughness measurements have been made on 130 sections and these measurements, together with condition records, are to be repeated each year to record changes in road condition.

Road cost information is being compiled for control sections within which test sections are located. Generally speaking, each test section is part of and representative of the design and usage of a longer control section.

These studies, as they reach maturity, will give a detailed picture of the character, total cost, and service performance of highways of different types and degrees of performance, and will permit comparisons useful for improvement of design and construction practice.

Brake research

The Bureau, in cooperation with industries associated with highway transportation, completed the field work and the analysis of data in an extensive study of motor-vehicle brake performance. It had the assistance of a committee composed of representatives of 20 organizations connected with highway transportation, 4 from Government agencies, and 16 from manufacturing, operating, and other technical groups.

This research was initially divided into three phases: Tests on vehicles in service, selected at random from the general traffic; tests on new commercial vehicles; and tests on used commercial vehicles. A fourth phase, tests to determine the capabilities of existing brake-testing devices, was added to the program and these tests were completed during the past year. Tests in the first, third, and fourth phases were made by the Bureau and those in the second phase by the Brake Technical Committee of the Automobile Manufacturers Association.

The analyses of all data have been completed and the final report is being prepared. The results of this research will assist materially in the formulation of practical regulatory measures and will help to promote safety on the streets and highways by pointing out deficiencies in the brake performance of vehicles as they operate in the everyday traffic.

Vehicle characteristics study

A knowledge of the operating characteristics of motor vehicles is of utmost importance in the development of highways and of vehicles that provide for the safest and most efficient movement of all types of traffic. The Committee on Vehicle Characteristics of the Highway Research Board, through the joint efforts of industry and government, has developed instruments which are used

to record, for any trip, the percentage of time a vehicle travels at various speeds, acceleration and deceleration, and the amount of fuel used at various speeds.

These instruments were installed in a passenger car and operated about 20,000 miles by the Bureau during the past year. Studies were made to determine the effect on travel of control of highway access, signals, rise and fall, gradient, and sight distance. Valuable data were obtained on fuel consumption and travel time as related to highway design.

The data collected, when analyzed and reported, should prove most valuable in the provision of adequately designed highways and vehicles.

Weighing vehicles in motion

Development and testing of an electronic scale for the weighing of vehicles in normal travel over a highway, without causing them to stop, was continued during the year.

The small errors in weights obtained by the electronic scale, averaging 1.5 percent for single axles and 4.2 percent for dual axles, confirmed early indications that weights of vehicles in motion could be obtained with a high degree of accuracy. However, frequent high individual errors showed the need for a continued study to insure a device with consistent accuracy.

Much has been done both mechanically and electrically to perfect the scale. Changes have been made in the arrangement for transmitting load to pressure cells. The oscillator and amplifier circuits have been redesigned to provide for more satisfactory operation. Extensive tests have been made with a direct recording oscillograph, and the electrical equipment has been constructed in a commercially reproducible form to replace the experimental hook-up of several separate instruments.

The data obtained in the second series of tests was being analyzed at the end of the year. A comparison of the results of the two series should make it possible to complete final design details for the electronic scale in the near future.

Accident studies

The relation of highway conditions to accidents has been under investigation for several years by the Bureau and the National Safety Council, in cooperation with several State motor-vehicle or State highway departments. Preliminary findings in a 15-State study of main rural highways were reported in 1946. Since that time, analyses of additional data have been made.

Some of the results of these analyses indicate that (1) a lightly traveled road, as a whole, is safer than a heavily traveled road (as might be expected), but the reverse is true on curves of two-lane roads; (2) sharp curves have higher accident rates than flat curves; (3) intersections, having less than 10 percent of the total traffic entering from a minor road, are relatively safe in comparison with intersections where a higher proportion enters from the minor road; and (4) two-lane bridges should have roadways at least 5 feet wider than the pavements on their approaches.

International road signs and signals

A Bureau representative served as one of a small group of experts on road signs and signals, set up by the United Nations in 1950 to develop a uniform system of road signs, signals, and markings for world-wide adoption. The second session of this group was held in Geneva, Switzerland, in August and September, 1951, and the final session was held in New York in the early summer of 1952. The Bureau contributed much material relating to current American standards, and conducted needed research on the effectiveness of proposed sign designs. The prospects for agreement on broad principles of uniformity are encouraging.

Hydraulic Research

Field study of flood damage to highway structures has revealed that modern bridges most often damaged are small structures intended to pass the water flowing on the flood plain outside the banks of the main channel. As a result improved methods of computing the required size of such structures are being developed, aided by laboratory data becoming available from research on bridge waterways by the United States Geological Survey.

A statistical study has been completed of stream flow and climatic data for the Allegheny-Cumberland Plateau—a region extending from western New York to Tennessee—which enables computation of the probable flood to be expected once in a given number of years for almost any stream in that region, whether or not there are continuous records of its flow.

This study shows how the length and slope of the main channel, the size of the drainage area (or watershed), and three rainfall characteristics all have a highly significant effect upon the peak flood for a given frequency.[2] The data utilized are all available from published records of the United States Geological Survey, the Weather Bureau, and the Soil Conservation Service, but are brought together for the first time to bear on the problem—how big a flood can be expected on a stream in a certain locality for which there are no direct measurements of flow.

The principal reason for destruction of bridges by floods is undermining of foundations by scour. A comprehensive laboratory study, now in its fifth year as an Iowa Federal-aid research project, is being conducted by the Iowa Institute of Hydraulic Research at Iowa City. Within the past year very significant results, upsetting previous concepts of the mechanism of scour, have been developed and reported to the Highway Research Board. It has been found that the depth of the local scour hole around a pier depends more on the general depth of water in the stream than on the velocity of flow. The next step is to obtain field measurements to verify tests made on a small-scale model.

The Institute is also conducting an investigation of the mechanics of movement and deposition of sediment in a pipe line. The close observation and control possible in the laboratory have disclosed that as the concentration of sediment increases the loss of pressure (or head) increases markedly and systematically. Heretofore designers of storm drains have been influenced by the presence of sediment only to the extent of attempting to maintain some minimum velocity. Results of these tests will be reported by the Institute.

A Federal-aid research project at Oregon State College promises to effect a major change in the concept of culvert hydraulics. Ordinary culverts frequently flow partly full for most of their length even when the water level in the upstream pond is well above the top of the entrance. A simple change in the shape of the entrance can cause the culvert barrel to flow full with a decrease in velocity and at the same time greatly lower the level of water in the pond. A report on this investigation is being prepared.

Research on flow of water through storm drain inlets has continued at the University of Illinois as a Federal-aid project of the Illinois Division of Highways.

During the past year nearly 1,000 highway engineers engaged in Federal, State, and local work in five States, have taken highway drainage short courses based on the Bureau's hydraulic charts. In California the course was organized and given by the Institute of Transportation and Traffic Engineering of the University of California at 15 locations to a total of about 800 engineers. Elsewhere courses were given by the Bureau.

[2] Being published in the Transactions of the American Geophysical Union, National Research Council.

Knowledge and practice in highway drainage are developing so rapidly that there is an articulate demand for in-service training in many States. The demand can be met only as more engineers are intensively trained to serve as instructors within their own organizations. The expansion of the in-service training function is essential to bringing about intelligent utilization of new techniques for economic design of drainage facilities. As a means of disseminating data, the first two of a series of hydraulic information circulars have been released to highway engineers and have attracted considerable interest. Ultimately they will be superseded by printed publications. In the meanwhile the new techniques are being given intensive field trial.

Physical Research

Under the sponsorship of the Committee on Materials of the American Association of State Highway Officials, a cooperative investigation of methods of testing the more commonly used highway materials was continued. This investigation, made under normal laboratory conditions, should assist in efforts to obtain uniform results among different laboratories engaged in testing highway materials. Active participation was continued in the work of various technical- and specification-writing authorities and associations. This included the preparation for different types of highway materials of a number of specifications in which the requirements were based more definitely on performance characteristics than on behavior under laboratory conditions.

Soil studies

Preparation of engineering soil and drainage maps on an area basis was continued in cooperation with New Jersey, Maine, and Virginia. In New Jersey, engineering soil reports and maps have been completed for six counties, and work is in progress in six other counties. Over 56 percent of the State has now been mapped. In Maine, sampling and testing of soils in a third trial area have been started, and data are being taken from aerial photographs for use in the preparation of the engineering soil map. In Virginia, the mapping of Charlotte County was completed. An engineering soil map was prepared from aerial photographs of the proposed Mississippi Parkway from the Canadian border to New Orleans.

A project has been initiated in cooperation with the Division of Soil Survey of the U. S. Department of Agriculture providing that soil samples taken during the mapping of each county surveyed will be submitted to the Bureau of Public Roads for tests to determine the properties of the soils of interest to engineers. From the test data and the agricultural soil survey information, an engineering soil map can be prepared. Samples have been tested from Fairfield County, Ohio, and Wills County, Ill. The ultimate goal is an engineering soil map of the entire United States.

The studies of vibratory methods of compaction of soil, which have been carried on in cooperation with Rutgers University and the New Jersey State Highway Department, were completed and the results incorporated into a summary report. A more detailed report is being prepared. As a result of this work, the New Jersey State Highway Department prepared and was putting into effect a specification covering the use of vibration equipment in the compaction of sands.

Very little data are available on the temperatures of soil materials in bases and subgrades underlying highway pavements. In connection with the tests of pavement at the experimental test track at Hybla Valley, Va., a large amount of data on the temperatures of the air, base course, and underlying soil was accumulated by means of automatic recording thermometers. These data are being analyzed and condensed into usable form.

Research on the identification and characterization of the basic constituents of soils designated as the basic clay minerals was continued. A report on an exploratory study of these minerals by means of the electron microscope was completed. A recording X-ray diffraction apparatus was installed and techniques for its use in soil analyses developed. Apparatus designed to detect quantitatively and identify basic clay minerals in soils by the measurement of reactions caused by heating to relatively high temperatures was ordered and will be installed at an early date. A quartz-prism spectrophotometer for rapid chemical analyses of soils was installed, and the special techniques required for its operation studied.

The study of shales for use in the construction of secondary roads in West Virginia was extended to include cherts and burned shales. The investigation includes abrasion, freezing and thawing, plasticity and volume-change tests, and a field study of the performance of sections of road in which the materials were used. Several field inspections were made during the year, and a comparison of test results with road conditions indicates a possible relation that may be useful in the future selection of materials.

Samples of aggregates and soils from Liberia were analyzed, and recommendations were prepared covering the use of the materials in the reconstruction of the main highway between Monrovia and Kakata.

Pilot studies were made in the laboratory to determine the value of beryllium, lithium, sodium, and aluminum sulphates, lignin binder (sulphite liquor) in combination with potassium bichromate, copper sulphate combined with portland cement, and fly ash as soil stabilizing agents. Similar studies were made of several of the synthetic organic chemicals such as krilium and aerotil. The results of these studies indicated that beryllium sulphate and lignin binder with potassium bichromate were sufficiently effective in increasing the strength and reducing the volume change of compacted soils to warrant more extensive investigation. The results indicate that the organic chemicals were not effective in stabilizing soils in subgrades.

A special slide-rule scale has been designed for use in a simplified method of making the liquid limit test proposed by the soils laboratory of the Washington State Highway Department. The new method and calculation with the special slide rule reduce the time required to make a test to about one-third of that necessary by the standard procedure. The method is sufficiently accurate for routine testing. A report describing the method and the slide rule was being prepared.

Cooperative soil-testing programs were carried on with State highway laboratories of the Mississippi Valley, the Southeastern, and the New York-New England groups of the American Association of State Highway Officials. The objective of this work was to explore the need for improvement in soil-testing methods and to develop better uniformity of procedure by laboratory technicians.

Study was continued of the cooperative experimental project on U S 41 in Lake County, Ind., which was planned to develop methods for preventing mud pumping at joints and cracks and along the edges of concrete pavements. A test road for similar cooperative study was under construction on U S 20 in Sandusky County, Ohio. On both of these projects, the concrete pavement was placed directly on the natural soil, on crushed stone subbases 3, 5, and 8 inches thick, and on soil-cement subbases 3 and 5 inches thick. Two gradations of crushed stone were used in the stone subbases. One gradation furnished a relatively free-draining material, but the other gave a dense base having a low permeability. No expansion joints and two spacings of contraction joints were specified on both projects. Observations of pumping, determination of the moisture contents of the subgrade and subbase, pavement roughness measurements, and pavement condition surveys were made on the Indiana project.

Instructions have been prepared to aid field engineers in properly designing and controlling the construction of vertical sand drains in soft soils to accelerate settlement, to provide suitable fill foundations, and to control lateral thrust against abutments of bridges.

The major activity in soil research has been the study of the subgrades on the Maryland test road. Approximately 1,200 samples were taken and 6,000 tests were made. A detailed analysis of the data was made to determine the relation between soil characteristics and pavement behavior.

Bituminous materials and mixtures

Research on materials for bituminous pavements is necessary because of the increasing needs of traffic and the expanding program of bituminous pavement construction, modernization, and maintenance.

Materials not formerly used but in plentiful or reasonable supply were studied to determine how they can be used and thus made to supplement other materials of decreasing availability. Bituminous and allied materials are being studied to determine more fully how their properties can be used to the best advantage under various conditions of service, as well as to determine how such properties can or should be modified to obtain more satisfactory behavior in service. Such studies result in the design of bituminous mixtures that will provide stable and durable pavements, the development of methods of correlating research results with service behavior, and the establishment of criteria on which specifications and methods of tests may properly be based. To attain these objectives a variety of field and laboratory studies have been and are being carried on, of which the following current investigations are typical.

A cooperative study of mineral fillers for bituminous concrete paving mixtures was completed and a report prepared. An important development from this study which was made with the assistance of the State highway departments of Massachusetts, New Jersey, and Ohio, and the National Crushed Stone Association, was the finding that the two hitherto troublesome byproducts may be used with good results as fillers.

Finely crushed traprock which has accumulated in large quantities as a waste product of crushing plants in Massachusetts was indicated to be as resistant to water action in bituminous concrete as limestone dust. Fly ash, or flue dust precipitated electrically from the stacks of steam-electric power plants that burn powdered coal, was found to be superior to limestone dust in its resistance to water action in bituminous concrete. Research provided new sources of supply of materials equal in some respects and superior in others to normally used materials and also furnished a new outlet for hitherto waste products.

Interest in the use of rubber with asphalt in bituminous construction has been maintained, and the number of experimental sections built by other agencies and available for study has been increased. The Bureau assisted in planning and will closely observe a test section built by the District of Columbia during the year. This experiment included several types of rubber and a so-called "plasticized" synthetic rubber. The rubber-asphalt experiments have not been under way a sufficient length of time to warrant conclusions on the skid-resistant properties or lower maintenance costs.

Laboratory studies of combinations of rubber powders and asphalts have shown that the properties of the blends (laboratory test results) may be considerably different from those of the asphalt alone, the degree of difference depending upon both the nature of the rubber and the type of asphaltic material. Laboratory tests are now being made to determine the effect of adding rubber to asphalt-aggregate combinations.

Cooperative studies of construction practices and of existing bituminous concrete pavements were continued. A typical example is the survey made in certain western States where a considerable amount of hot-plant bituminous mixture was being laid instead of the road-mix types previously used. Observations of the new type of construction were made, older surfaces were inspected, and a report was prepared on two types of construction, presenting some of the problems encountered and recommending possible means of solving them.

Research studies of test methods continued to develop additional or supplemental tests applicable to new materials and combinations, to correlate more definitely laboratory results with service performance, and to standardize procedures to obtain uniform results. Examples of research of this nature are the studies of methods of test for rubber-asphalt combinations, investigations of factors affecting the triaxial and the immersion-compression methods of test, and the cooperative testing work with the American Association of State Highway Officials.

Cement, aggregates, and concrete

The investigation of the use of fly ash as a partial replacement of portland cement in concrete for pavement was continued. The results of pilot tests of mortar made with samples of fly ash show satisfactory compressive strengths of mixtures of fly ash and portland cement. Concrete specimens containing fly ash were made for future testing. Chemical analyses were made to study the reaction between portland cement and pozzolanic materials such as fly ash, and to develop, if possible a chemical method of measuring pozzolanic activity.

Study of the chemical reaction between the alkali in portland cement and soluble silica in aggregate was continued. As reports were received on the failure of concrete prepared with low-alkali cements, a summation of available data was made to permit analysis of the behavior of low-alkali and high-alkali cements in combination with aggregates containing varying amounts of reactive silica. It was found that the expansion due to chemical reaction is not dependent on the percentage of alkali as had previously been believed, but rather on the ratio of the alkali to the reactive material in the aggregate. A given aggregate may have a much greater reaction with a low-alkali cement than with a high-alkali cement. The use of low-alkali cement is no surety that concrete with a small amount of expansion will be obtained.

The information obtained on the behavior of concrete prepared with low-alkali cement has developed new interest in the problem of sand-gravel concrete as used in Kansas and Nebraska. The addition to the sand-gravel of about 30 percent of limestone results in concrete having durability much superior to that of plain sand-gravel concrete. To determine whether the conclusion as to the alkali-reactive aggregate ratio applies, samples of sand-gravel and limestone were obtained and a preliminary series of tests started to determine the most favorable size of specimen for sand-gravel concrete.

Reports have been received of slippery pavement surfaces of both portland cement concrete and bituminous macadam. Limited observations in the field appear to show that the slipperyness is associated with the type of aggregate used. To determine whether aggregates that result in slippery pavement surfaces could be identified by tests in the laboratory, a large number of samples of crushed stone were obtained and subjected to customary tests for physical properties. In addition, a small apparatus was designed to measure the static and kinetic coefficients of friction of pavement surfaces. Development of a standard method of test was in progress.

Under the auspices of a Committee of the American Society of Testing Materials, a cooperative investigation of methods for determining the air-entraining

characteristics of portland cements was completed. The tests involved the determination of air in mortar prepared with seven cements and eleven different procedures for the preparation of the mortar including mixing both by hand and by machine. It is hoped that study of the data furnished by the cooperating laboratories will indicate clearly which of the several methods gives the most reliable results.

Several authorities on aggregates for highway construction have expressed dissatisfaction with the mortar strength test used for the determination of the quality of fine aggregates. Efforts to measure the quality of natural sand by abrasion or crushing tests have shown little promise, as the test results for different sands usually are of nearly the same magnitude. Abrasion tests recently completed on two samples of sand submitted for routine examination indicate that with certain revisions the method of test may furnish results of greater significance than has previously been believed. Another study of this method will be made, using quartz sand to which known percentages of material of questionable quality have been added.

The study of air-entrainment in concrete was continued, to determine more fully its advantages in rendering concrete resistant to damage by freezing and thawing. Tests of 26 proprietary air-entraining admixtures were completed and 25 of these were approved for use in concrete in the construction of roads and bridges in Federal areas. The admixture not approved was still in the development stage.

An apparatus to determine the size and distribution of air voids was used extensively in studies of concrete from the German Autobahn and from various locations in this country. It was found that concrete having the most marked resistance to freezing and thawing contains minute, evenly distributed air voids. A method was developed for the preparation of a reproduction of a section of concrete showing the amount of beneficial entrained air.

Methods of protecting the surface of portland cement concrete from the destructive effect of flake calcium chloride used for the removal of ice have long been of interest to highway engineers. To determine the efficacy of various methods proposed, thin films of ice were frozen repeatedly on concrete test specimens, and thawed by the application of controlled quantities of calcium chloride. Large concrete slabs for freezing under natural conditions and small slabs for freezing in the laboratory were prepared with both plain and air-entrained concrete. Other specimens were prepared with admixtures of petroleum oils, or were given surface applications of oil and other waterproofing or densifying compounds. The results of these tests show that all of the air-entraining materials used were of value in delaying the scaling of the concrete, but few gave complete protection. Further tests of these materials were begun.

Natural cement has been used extensively in certain areas in combination with portland cement to produce concrete of superior resistance to freezing and thawing. Recently a treated cement prepared from blast furnace slag has been proposed for use in place of the natural cement. Tests were made to compare the frost resistance and strength of concrete prepared with blends of portland and natural or slag cement. The slag cement was found to equal or excel the natural cement when used as a replacement of a portion of portland cement in concrete for pavement construction.

The long-time study of the performance of cement in concrete has been continued with periodic inspections of the specimens exposed to the weather in the test plot at the laboratory as well as inspections of full-size experimental installations in the field. In the most recent inspection, many of the specimens of concrete prepared with 4½ sacks of cement per cubic yard, and a 6-inch slump, were starting to show scaling, cracking, and softening of the mortar.

An investigation of the sources and methods of analysis of air-entraining admixtures for concrete was made. It was found that relatively simple and rapid methods of chemical analysis can be used to determine the uniformity of different lots of the same product, thus filling a need that has been apparent to all consumers of these products for some time.

Structural design of rigid pavements

Through cooperative arrangements between the Bureau and the California, Kentucky, Michigan, Minnesota, Missouri, and Oregon State highway departments, there were constructed in 1940 and 1941 six experimental concrete pavements, one in each State, for the principal purpose of determining the amount of expansion space needed in concrete pavements. The subject was one about which there was a considerable difference of opinion. These six experimental pavements, subjected to differing conditions of climate and traffic, were systematically studied by the State highway departments. After 10 years of service, six reports of performance were prepared and the findings released through the Highway Research Board. The results of the studies indicate that when concrete pavements are constructed with closely spaced contraction joints, as is the general practice today, the requirements for expansion space are greatly reduced. These findings are being put to use by an increasing number of State highway departments. The reduction in the number of expansion joints leads to improved pavement performance, smoother pavement surfaces, and other benefits.

The study of the effects of various amounts of longitudinal steel reinforcement in concrete pavements undertaken in 1938 in cooperation with the Indiana State Highway Commission, was the subject of a comprehensive 10-year report in 1949. However, the experimental pavement sections are being kept under observation for any further developments of structural significance.

It has been observed, in some instances, that the tendency for concrete pavements to crack transversely varies with the type or source of the coarse aggregate used in the concrete. Adequate information regarding this relation is not available and the phenomenon itself is not well understood. To obtain additional information, an exploratory study was undertaken in which the thermal expansivity of concretes made with selected aggregates obtained from several States were to be measured by means of various field exposure tests and laboratory determinations. An adequate knowledge of this subject would permit a more rational spacing of contraction joints for the control of transverse cracking.

Studies of the structural behavior of joints containing load transfer systems under the action of repeated loads were continued. Two machines capable of applying 10,000-pound loads and two capable of applying 15,000-pound loads were constructed. The data obtained indicate that important information on the design of this structural feature of concrete pavements will be developed by this research.

The extensive load strain measurements made in the course of the program of the Maryland Road Test were analyzed in detail during the year and a comprehensive report on this part of the test program has been completed. The report is an important contribution to the knowledge of the structural action of concrete pavements, particularly with respect to the effects of moving vehicles on pavement stress.

Structural design of nonrigid pavements

Mention was made in last year's report of the work being done by the State highway departments in the development and use of improved methods of design of nonrigid pavements. These methods involve considering in a systematic manner the important variables entering into the problem, including the charac-

ter of the subgrade soil, the amount and type of traffic, the quality of the pavement, and climatic conditions. Practically all State highway departments made use of some method of design of this nature and constantly endeavored by research and observation of pavements in service to improve and place the methods on a more scientific basis. The Bureau is greatly interested in this work and through contacts with the States and technical committee activities lent as much encouragement and assistance as possible.

Work on the cooperative investigation of nonrigid pavement design was continued. The static load tests were completed and moving load tests were underway. At the end of the year it was anticipated that the scheduled test would be completed in about two years.

The Idaho test road

Ten of the Western States, the Bureau of Public Roads, the truck-manufacturing industry, and the petroleum industry agreed to cooperate in the construction and load testing of a bituminous pavement in Idaho. The investigation was placed under the direction of the Highway Research Board. The project is similar in many respects to the Maryland Road Test, except that the pavement was to be of the nonrigid type, and was being built according to a predetermined design rather than using an existing pavement as was done in Maryland.

The pavement, consisting of a number of different designs, was being built in the form of two loops. A different axle load will be used to test each lane in each loop. The principal purpose of the investigation is to develop basic information regarding the design requirements of this type of pavement to support single- and tandem-axle loads of different magnitudes. The Bureau accepted an important role in the planning and conduct of the investigation. In addition to supplying technical assistance in planning the test program, it undertook fabrication of the instruments which will be used to record scientifically the effects of the moving loads upon the pavement, and will assist in field work throughout the tests.

Bridges

Mention has been made in previous reports of a study of the self-damping characteristics of structural members, undertaken at the request of the Advisory Board on the Investigation of Suspension Bridges. The testing program was concluded with the testing of the trussed member in a riveted condition and with a determination of the physical properties of the material in all of the specimens. Work was begun on a comprehensive report of the investigation.

The study of the relative value of waterproofing treatments applied to protect electrical resistance strain gages mounted on steel plates and exposed to the weather was concluded and the findings reported. The tests indicate that it is possible to keep gages in satisfactory working condition over protracted periods of outdoor exposure by certain protective coatings. This study was undertaken in anticipation of a program of strain measurements on highway bridges under the action of loaded motor vehicles, in the course of which electrical resistance strain gages would be employed.

Other physical research

Road surface roughness is of interest to all who are concerned with highway use. Evaluation of surface roughness by physical measurements of some sort is being attempted by more State highway departments and other agencies each year. The equipment developed by the Bureau probably has been more generally accepted than any other one type. However, in some cases modifications of the basic equipment were made or proposed by individual users. Such proposals

are always of interest to the Bureau and two are under study. Plans for the equipment have been supplied to a number of State and foreign governmental agencies during the year.

Interest in the use of the electrical resistivity and the seismic methods of subsurface exploration for highway engineering purposes continues to increase. Each year additional State highway organizations are equipping themselves for this type of work as they become acquainted with the usefulness of the methods. During the fiscal year the resistivity method was used by the Bureau on subsurface explorations to obtain design data for several grading projects. A study was made of the application of the methods at a slide area in Ohio and useful information was obtained.

Appendix

LIST OF TABLES

Table 1.—*Summaries of programs approved and work completed in the fiscal year 1952, by class of highway and by fund*

	PROGRAMS APPROVED [1]						WORK COMPLETED					
				Railway-highway crossing improvements						Railway-highway crossing improvements		
	Total cost	Federal funds	Miles	Crossings eliminated	Structures reconstructed	Crossings protected	Total cost	Federal funds	Miles	Crossings eliminated	Structures reconstructed	Crossings protected
	BY CLASS OF HIGHWAY						BY CLASS OF HIGHWAY					
Primary	$505,968,367	$261,255,839	6,601.3	57	4	151	$331,393,583	$169,663,215	5,627.5	51	14	91
Secondary	391,332,309	207,144,722	18,112.8	17	4	175	217,403,317	111,504,577	11,108.9	16	5	202
Urban	358,581,238	183,023,243	740.2	69	7	31	274,476,237	137,119,152	772.0	66	13	48
Subtotal	1,255,881,914	651,423,804	25,454.3	143	15	357	823,273,137	418,286,944	17,508.4	133	32	341
Not classified [2]	37,945,345	31,970,954	545.0				22,882,441	18,610,952	601.3			
Total	1,293,827,259	683,394,758	25,999.3	143	15	357	846,155,578	436,897,896	18,109.7	133	32	341
	BY FUND						BY FUND					
Federal-aid:												
Primary	$556,476,344	$285,864,731	6,886.3	68	6	166	$376,862,829	$190,994,937	6,038.6	52	17	106
Secondary	384,830,312	198,611,266	17,080.6	18	4	174	213,699,452	108,817,248	10,944.8	12	6	188
Urban	294,739,080	149,047,373	294.7	56	5	12	209,000,566	103,458,339	279.6	54	6	12
Prewar Federal-aid:												
Primary							6,942,670	3,485,177	34.7			
Secondary							3,984,098	2,104,964	89.0			
Grade crossing	24,460	24,460				3	6,789,294	5,792,151	28.6	13	3	35
Access roads, Act of 1950	19,811,718	17,875,974	1,192.7	1		2	1,106,061	827,848	93.1			
Emergency highway and grade crossing							720,883	720,883		2		
Defense Highway Act							4,167,284	2,085,397				
Subtotal	1,255,881,914	651,423,804	25,454.3	143	15	357	823,273,137	418,286,944	17,508.4	133	32	341
National forest highway [3]	18,205,323	17,256,434	399.1				12,668,519	11,618,206	352.8			
Tongass National Forest, Alaska [3]	3,779,500	3,769,500	17.8									
National park and parkway [4]	3,476,050	3,476,050	32.2				3,426,981	3,426,981	103.0			
Public lands	2,533,000	2,506,000	18.0				565,733	532,550	21.7			
Emergency flood relief	9,951,472	4,962,970	77.9				6,221,208	3,033,215	123.8			
Subtotal	37,945,345	31,970,954	545.0				22,882,441	18,610,952	601.3			
Total	1,293,827,259	683,394,758	25,999.3	143	15	357	846,155,578	436,897,896	18,109.7	133	32	341

[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, 1952, 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	$679,219,845	$348,922,919	8,141.2	91	12	93
Secondary	392,478,513	206,404,123	15,995.3	31	7	181
Urban	660,407,548	332,222,201	1,097.8	139	18	43
Subtotal	1,732,105,906	887,549,243	25,234.3	261	37	317
Not classified [1]	60,034,041	53,217,802	981.8			
Total	1,792,139,947	940,767,045	26,216.1	261	37	317
By Fund						
Federal-aid:						
Primary	$768,978,221	$392,352,978	8,611.4	112	17	116
Secondary	388,217,837	198,144,419	15,313.2	31	7	179
Urban	539,228,212	268,992,322	432.0	112	12	15
Prewar Federal-aid:						
Grade crossing	5,088,395	3,249,668	2.1	4	1	5
Access roads, Act of 1950	19,137,356	17,942,028	869.1	2		2
Emergency highway and grade crossing, Defense Highway Act	11,455,885	6,867,828	6.5			
Subtotal	1,732,105,906	887,549,243	25,234.3	261	37	317
National forest highway [2]	29,411,787	27,230,962	610.6			
Tongass National Forest, Alaska [2]	3,779,500	3,769,500	17.8			
National park and parkway [3]	17,250,650	17,250,650	217.5			
Public lands	1,071,589	1,009,870	30.3			
Emergency flood relief	8,520,515	3,956,820	105.6			
Subtotal	60,034,041	53,217,802	981.8			
Total	1,792,139,947	940,767,045	26,216.1	261	37	317

[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 ended June 30, 1953*

State or Territory	Primary highway system ($225,000,000)	Secondary or feeder roads ($150,000,000)	Urban highways ($125,000,000)	Total
Alabama	$4, 667, 971	$3, 621, 928	$1, 586, 037	$9, 875, 936
Arizona	3, 294, 585	2, 243, 550	470, 881	6, 009, 016
Arkansas	3, 659, 614	2, 931, 245	677, 225	7, 268, 084
California	10, 160, 691	5, 233, 338	10, 761, 356	26, 155, 385
Colorado	3, 988, 333	2, 663, 606	1, 006, 137	7, 658, 076
Connecticut	1, 401, 852	721, 875	2, 344, 571	4, 468, 298
Delaware	1, 082, 813	721, 875	248, 278	2, 052, 966
Florida	3, 513, 455	2, 295, 574	2, 170, 778	7, 979, 807
Georgia	5, 491, 196	4, 190, 994	1, 764, 294	11, 446, 484
Idaho	2, 737, 218	1, 924, 535	232, 987	4, 894, 740
Illinois	8, 518, 157	4, 638, 620	8, 466, 307	21, 623, 084
Indiana	5, 248, 078	3, 616, 889	2, 896, 230	11, 761, 197
Iowa	5, 376, 541	3, 931, 409	1, 437, 217	10, 745, 167
Kansas	5, 404, 541	3, 781, 841	1, 137, 837	10, 324, 219
Kentucky	4, 062, 250	3, 373, 828	1, 257, 187	8, 693, 265
Louisiana	3, 413, 927	2, 472, 350	1, 774, 598	7, 660, 875
Maine	1, 864, 396	1, 333, 474	505, 956	3, 703, 826
Maryland	1, 935, 063	1, 182, 205	2, 054, 609	5, 171, 877
Massachusetts	2, 783, 698	1, 026, 797	5, 038, 809	8, 849, 304
Michigan	6, 877, 365	4, 196, 989	5, 634, 433	16, 708, 787
Minnesota	5, 822, 661	4, 106, 109	1, 971, 328	11, 900, 098
Mississippi	3, 946, 486	3, 287, 577	670, 253	7, 904, 316
Missouri	6, 369, 052	4, 309, 461	2, 981, 397	13, 659, 910
Montana	4, 475, 436	3, 077, 359	285, 067	7, 837, 862
Nebraska	4, 294, 741	3, 045, 380	710, 025	8, 050, 146
Nevada	2, 863, 524	1, 913, 466	92, 199	4, 869, 189
New Hampshire	1, 082, 813	721, 875	351, 161	2, 155, 849
New Jersey	2, 865, 782	967, 042	5, 299, 454	9, 132, 278
New Mexico	3, 618, 689	2, 485, 056	397, 303	6, 501, 048
New York	10, 383, 535	4, 159, 385	16, 181, 382	30, 724, 302
North Carolina	5, 449, 728	4, 659, 539	1, 555, 635	11, 664, 902
North Dakota	3, 225, 855	2, 340, 775	204, 704	5, 771, 334
Ohio	7, 696, 430	4, 680, 567	7, 005, 558	19, 382, 555
Oklahoma	4, 742, 881	3, 394, 931	1, 322, 620	9, 460, 432
Oregon	3, 798, 278	2, 653, 463	970, 723	7, 422, 464
Pennsylvania	8, 680, 399	5, 165, 523	9, 164, 833	23, 010, 755
Rhode Island	1, 082, 813	721, 875	865, 420	2, 670, 108
South Carolina	2, 985, 798	2, 470, 183	832, 764	6, 288, 745
South Dakota	3, 452, 003	2, 465, 050	235, 135	6, 152, 188
Tennessee	4, 711, 574	3, 680, 474	1, 750, 601	10, 142, 649
Texas	14, 305, 046	9, 577, 321	5, 799, 612	29, 681, 979
Utah	2, 540, 514	1, 680, 413	512, 969	4, 733, 896
Vermont	1, 082, 813	721, 875	188, 498	1, 993, 186
Virginia	4, 204, 200	3, 266, 315	1, 887, 806	9, 358, 321
Washington	3, 666, 653	2, 449, 109	1, 826, 656	7, 942, 418
West Virginia	2, 409, 873	2, 097, 655	787, 881	5, 295, 409
Wisconsin	5, 254, 962	3, 664, 818	2, 370, 616	11, 290, 396
Wyoming	2, 757, 134	1, 868, 238	131, 630	4, 757, 002
District of Columbia	1, 082, 813	721, 875	1, 045, 855	2, 850, 543
Hawaii	1, 082, 813	721, 875	407, 089	2, 211, 777
Puerto Rico	1, 145, 457	1, 197, 494	1, 040, 599	3, 383, 550

Table 4.—*Status of plan preparation for future construction of Federal-aid and State highways, and highways in National forests and other Federal areas, as of April 1, 1952*

State or Territory	Plans under way		Plans completed		Total	
	Construction cost	Miles	Construction cost	Miles	Construction cost	Miles
	1,000 dollars		*1,000 dollars*		*1,000 dollars*	
Alabama	31,571	542	9,834	130	41,405	672
Arizona	8,000	100	1,000	20	9,000	120
Arkansas	17,019	483	11,109	261	28,128	744
California	721,236	1,780	40,279	176	761,515	1,956
Colorado	18,301	674	4,506	245	22,807	919
Connecticut	127,970	177	6,200	25	134,170	202
Delaware	10,270	53	2,500	8	12,770	61
Florida	30,000	150	20,000	400	50,000	550
Georgia	57,656	3,046	23,868	321	81,524	3,367
Idaho	43,178	664	9,894	159	53,072	823
Illinois	101,834	1,264	35,732	540	137,566	1,804
Indiana	118,144	946	22,410	160	140,554	1,106
Iowa	45,000	1,750	6,000	250	51,000	2,000
Kansas	30,492	1,476	9,215	313	39,707	1,789
Kentucky	31,563	809	36,238	1,501	67,801	2,310
Louisiana	34,142	349	21,777	235	55,919	584
Maine	18,438	68	5,422	20	23,860	88
Maryland	146,738	187	25,328	106	172,066	293
Massachusetts	90,363	112	28,849	17	119,212	129
Michigan	85,500	625	25,000	250	110,500	875
Minnesota	65,341	2,173	19,859	1,233	85,200	3,406
Mississippi	28,252	746	8,183	264	36,435	1,010
Missouri	27,233	360	20,806	529	48,039	889
Montana	24,712	528	3,833	83	28,545	611
Nebraska	26,685	747	1,966	74	28,651	821
Nevada	14,262	424	6,193	395	20,455	819
New Hampshire	11,060	79	1,385	12	12,445	91
New Jersey	302,971	298	35,981	63	338,952	361
New Mexico	9,549	304	5,528	103	15,077	407
New York	157,000	633	85,000	265	242,000	898
North Carolina	53,654	798	15,721	353	69,375	1,151
North Dakota	3,808	265	9,336	493	13,144	758
Ohio	111,694	377	25,572	236	137,266	613
Oklahoma	27,448	518	6,024	102	33,472	620
Oregon	21,257	228	13,775	171	35,032	399
Pennsylvania	356,142	1,460	176,826	1,200	532,968	2,660
Rhode Island	23,035	50	7,834	6	30,869	56
South Carolina	26,000	550	3,000	100	29,000	650
South Dakota	9,819	557	8,435	566	18,254	1,123
Tennessee	50,737	1,133	11,405	204	62,142	1,337
Texas	65,427	3,084	19,513	749	84,940	3,833
Utah	24,821	552	3,636	43	28,457	595
Vermont	8,046	82	2,600	38	10,646	120
Virginia	53,233	1,118	26,164	462	79,397	1,580
Washington	192,483	1,670	9,236	83	201,719	1,753
West Virginia	10,701	137	3,638	58	14,339	195
Wisconsin	31,020	810	8,000	200	39,020	1,010
Wyoming	24,241	775	1,365	16	25,606	791
Alaska	13,126	185	1,814	14	14,940	199
District of Columbia	20,141	23	26,578	15	46,719	38
Hawaii	19,000	46	11,686	27	30,686	73
Puerto Rico	8,918	78	5,103	13	14,021	91
Total	3,589,231	36,043	931,156	13,307	4,520,387	49,350

Table 5.—*Projects financed with Federal-aid funds programed [1] during the fiscal year ended June 30, 1952, by State*

State or Territory	Primary			Secondary			Urban			Total		
	Total cost	Federal funds	Miles	Total cost	Federal funds	Miles	Total cost	Federal funds	Miles	Total cost	Federal funds	Miles
Alabama	$25,697,540	$13,051,130	264.5	$10,929,197	$5,295,971	528.1	$1,507,470	$1,239,481	1.4	$38,134,207	$19,586,582	794.0
Arizona	7,408,917	4,692,637	106.0	5,537,356	3,957,130	135.3	371,548	244,420	2.5	13,317,821	8,894,187	243.8
Arkansas	9,234,160	4,620,024	179.0	5,590,913	2,788,827	283.0	1,550,790	775,395	14.2	16,375,863	8,184,246	476.2
California	25,675,304	12,334,910	62.7	13,812,559	6,864,503	248.1	31,388,960	12,636,401	15.9	70,876,823	31,835,814	326.7
Colorado	5,899,897	2,735,187	91.2	5,533,706	3,076,824	184.4	26,916	15,209	----------	11,460,519	5,827,220	275.6
Connecticut	2,581,225	1,273,722	13.0	290,255	143,744	1.5	1,342,645	645,107	.9	4,214,125	2,062,573	15.4
Delaware	5,636,216	2,413,383	27.5	1,838,559	914,386	15.4	9,072	3,754	----------	7,483,847	3,331,523	42.9
Florida	8,440,614	4,257,445	107.8	7,930,248	4,088,121	285.7	5,475,924	2,737,860	7.1	21,846,786	11,083,426	400.6
Georgia	15,731,343	8,085,058	173.5	15,471,594	7,813,033	691.4	2,362,871	853,455	2.0	33,565,808	16,751,546	866.9
Idaho	7,117,220	4,454,309	111.2	2,077,032	1,340,653	56.5	455,838	285,124	2.2	9,650,090	6,080,086	169.9
Illinois	28,996,484	14,743,058	322.0	12,893,681	6,334,266	465.4	27,356,800	14,555,900	22.1	69,246,965	35,633,224	809.5
Indiana	16,695,602	8,373,447	220.5	10,827,354	5,371,265	276.1	10,938,204	7,105,781	11.2	38,461,160	20,850,493	507.8
Iowa	13,232,519	6,870,235	239.5	11,069,532	5,546,663	789.7	3,913,012	2,131,506	15.8	28,215,063	14,548,404	1,045.0
Kansas	11,106,849	5,571,033	264.1	7,631,965	3,810,493	1,022.3	1,257,840	643,140	3.7	19,996,654	10,024,666	1,290.1
Kentucky	11,536,374	5,829,294	170.3	12,193,861	6,108,530	499.4	2,977,928	2,014,787	13.7	26,708,163	13,952,611	683.4
Louisiana	10,136,233	5,022,333	115.0	7,860,764	3,848,782	103.9	6,547,714	3,197,367	.8	24,544,711	12,068,482	219.7
Maine	6,566,904	3,334,832	43.4	4,446,888	2,233,524	73.0	1,474,600	767,800	5.3	12,488,392	6,336,156	121.7
Maryland	5,476,980	2,422,941	15.9	5,432,795	2,625,614	126.2	451,756	225,878	1.8	11,361,531	5,274,433	143.9
Massachusetts	96,220	51,060	----------	1,982,016	1,116,008	17.9	5,944,232	2,966,576	.9	8,022,468	4,133,644	18.8
Michigan	20,122,218	9,987,853	175.3	12,971,461	6,757,306	504.1	13,533,573	6,740,671	1.9	46,627,252	23,485,830	681.3
Minnesota	14,305,523	7,331,012	408.0	9,924,734	5,086,647	1,335.8	2,770,995	1,495,599	14.6	27,001,252	13,913,258	1,758.4
Mississippi	13,581,166	7,113,982	275.9	10,496,316	5,122,535	622.0	1,190,974	595,487	1.9	25,268,456	12,832,004	899.8
Missouri	13,712,599	7,008,300	112.2	14,398,800	7,210,840	929.0	8,109,986	4,031,713	3.0	36,221,385	18,250,853	1,044.2
Montana	1,617,647	926,924	29.8	2,326,895	1,335,245	79.1	37,583	33,495	.1	3,982,125	2,295,664	109.0
Nebraska	5,510,840	2,762,737	169.1	4,144,784	2,081,571	348.4	871,862	461,131	.4	10,527,486	5,305,439	517.9
Nevada	6,965,650	5,510,460	166.1	3,550,165	2,973,781	270.7	1,657	1,394	----------	10,517,472	8,485,635	436.8
New Hampshire	3,113,904	1,554,643	13.7	2,466,340	1,231,979	23.5	1,436,687	718,344	5.6	7,016,931	3,504,966	42.8
New Jersey	7,497,233	3,723,158	17.0	3,850,682	1,893,300	45.7	15,971,363	7,952,578	10.1	27,319,278	13,569,036	72.8
New Mexico	6,688,542	4,280,915	146.4	7,129,518	4,525,983	326.4	825,400	528,338	5.1	14,643,460	9,335,236	477.9
New York	41,655,576	19,701,203	313.2	18,287,438	8,940,457	160.2	40,100,610	20,062,137	25.0	100,043,624	48,703,797	498.4
North Carolina	13,356,850	6,172,425	174.2	13,926,230	6,853,475	434.5	4,278,167	2,104,876	8.6	31,561,247	15,130,776	617.3
North Dakota	7,516,988	3,865,462	373.8	5,832,352	2,915,986	938.0	625,530	327,069	1.1	13,974,870	7,108,517	1,312.9

Ohio	20,370,281	10,241,750	64.0	12,618,962	6,468,295	81.3	17,593,495	8,375,907	12.8	50,582,738	25,085,952	158.1
Oklahoma	16,760,131	8,784,936	223.9	7,603,075	3,980,651	245.5	3,203,018	1,692,929	5.4	27,566,224	14,458,516	474.8
Oregon	6,290,926	3,834,974	101.6	5,152,800	3,098,901	145.1	565,304	349,560	2.0	12,009,030	7,283,435	251.7
Pennsylvania	21,596,475	10,782,455	31.2	14,136,456	7,060,728	145.2	32,536,258	16,257,835	11.5	68,269,189	34,101,018	187.9
Rhode Island	4,028,906	2,014,453	14.3	898,181	449,090	4.4	1,394,126	697,063	.4	6,321,213	3,160,606	19.1
South Carolina	6,048,344	3,276,121	26.0	7,298,326	3,554,863	581.4	1,658,639	1,082,679	3.8	15,005,309	7,913,663	611.2
South Dakota	8,299,456	4,819,940	330.5	5,593,664	3,227,391	503.5	444,274	249,379	2.4	14,337,394	8,296,710	836.4
Tennessee	9,768,328	4,715,164	88.4	13,017,914	6,512,337	775.3	1,244,822	576,911	2.6	24,031,064	11,804,412	866.3
Texas	29,136,791	15,472,467	492.1	18,686,527	9,330,715	1,321.8	7,215,428	3,975,550	10.7	55,038,746	28,778,732	1,824.6
Utah	2,932,546	2,184,474	62.1	3,173,250	2,371,710	131.2	1,816,608	1,429,189	7.7	7,922,404	5,985,373	201.0
Vermont	904,561	520,909	4.4	1,787,483	893,530	37.4	311,254	155,626	2.0	3,003,301	1,570,065	43.8
Virginia	12,122,556	6,152,426	109.9	10,740,968	5,443,352	292.8	4,893,252	2,458,214	11.8	27,756,776	14,053,992	414.5
Washington	10,755,363	5,328,784	117.2	6,031,594	3,049,127	267.4	5,239,323	3,179,952	3.3	22,026,280	11,557,863	387.9
West Virginia	7,926,854	3,970,110	55.2	6,312,551	3,177,905	109.0	2,161,626	1,080,813	.2	16,401,031	8,228,828	164.4
Wisconsin	13,180,894	6,421,538	157.8	9,694,365	4,524,892	444.5	7,839,047	4,255,009	17.0	30,714,306	15,201,439	619.3
Wyoming	5,415,104	3,526,900	83.2	3,720,682	2,428,465	156.1	1,989	1,989	----------	9,137,775	5,957,354	239.3
District of Columbia	4,112,226	1,811,070	1.2	3,791,725	1,892,512	.7	8,342,994	3,595,497	.6	16,246,945	7,299,079	2.5
Hawaii	3,647,372	1,797,386	18.5	738,110	369,055	6.0	2,192,116	1,047,498	.9	6,577,598	3,213,939	25.4
Puerto Rico	267,890	133,762	----------	1,177,689	570,305	11.3	977,000	488,000	.7	2,422,579	1,192,067	12.0
Total	556,476,344	285,864,731	6,886.3	384,830,312	198,611,266	17,080.6	294,739,080	149,047,373	294.7	1,236,045,736	633,523,370	24,261.6

[1] Initial commitment of funds.

Table 6.—*Projects involving Federal funds awarded to contract [1] during the fiscal year ended June 30, 1952, by program and by State*

State or Territory	Total cost	Total Federal funds	Federal-aid funds			Prewar Federal-aid funds			Other	Miles
			Primary [2]	Secondary	Urban	Primary	Secondary	Grade crossing		
Alabama	$15,098,061	$8,402,679	$3,530,687	$3,297,540	$1,574,452					457.6
Arizona	14,041,404	9,802,980	5,656,338	3,017,814	493,078				$635,750	364.5
Arkansas	16,664,086	8,276,642	4,971,819	3,171,257	130,505	$3,061				528.5
California	60,448,612	29,867,245	11,222,608	6,165,835	12,440,802				38,000	295.9
Colorado	17,483,084	9,499,112	4,373,445	3,031,889	394,650				1,699,128	485.1
Connecticut	7,443,763	3,645,098	407,707	826,514	2,410,877					20.1
Delaware	5,830,556	2,558,404	1,412,722	1,141,928	3,754					49.4
Florida	14,438,610	7,317,921	3,561,282	2,314,811	1,411,788				30,040	271.6
Georgia	25,769,877	12,392,450	5,094,840	4,616,861	2,330,749				350,000	450.1
Idaho	9,126,938	5,850,593	3,184,258	2,139,949	284,452	884			241,050	254.0
Illinois	52,852,014	26,553,970	14,417,037	2,814,193	9,322,740					602.4
Indiana	28,723,422	14,952,856	9,314,177	2,478,962	2,835,342			$324,375		454.9
Iowa	23,884,426	11,966,782	5,588,509	4,798,042	1,580,231					984.7
Kansas	14,787,867	7,763,068	4,142,745	2,190,000	1,430,323					1,023.0
Kentucky	18,463,709	9,608,729	4,486,217	3,775,354	1,166,482				180,676	400.5
Louisiana	25,908,535	12,848,828	6,194,690	3,425,148	3,141,480	79,590	$7,920			241.1
Maine	11,177,469	6,654,158	3,024,944	1,429,756	302,948				1,896,510	88.2
Maryland	6,843,644	3,898,722	1,847,535	285,331	1,765,856					100.8
Massachusetts	15,409,398	7,654,495	3,651,173	1,353,322	2,650,000					37.5
Michigan	37,324,592	18,429,321	7,678,775	4,831,806	5,918,740					581.5
Minnesota	23,307,612	12,008,618	6,324,790	4,234,497	1,424,369		24,962			1,399.9
Mississippi	14,913,435	7,427,654	3,402,989	2,700,818	1,323,847					501.0
Missouri	25,307,747	12,801.710	5,236,315	4,058,560	3,506,835					601.1
Montana	15,344,583	9,238,596	4,320,080	4,285,684	580,202	43,564	9,066			369.1
Nebraska	11,574,123	5,879,790	4,339,083	1,503,610	37,097					351.9
Nevada	6,487,111	5,442,309	3,378,062	1,752,313	1,394				310,540	393.2
New Hampshire	4,279,555	2,130,227	1,078,001	931,383	114,656				6,187	32.3
New Jersey	25,149,373	12,524,771	2,261,500	604,381	9,531,522				127,368	35.5
New Mexico	11,516,004	7,347,789	4,530,044	2,555,007	262,738					360.8
New York	60,570,369	27,944,517	9,158,883	7,507,357	11,243,606	16,871			17,800	485.5
North Carolina	18,124,971	8,605,615	4,067,364	4,062,976	345,965				129,310	391.4
North Dakota	13,716,580	6,909,735	3,895,602	2,515,939	498,194					1,512.2

Ohio	31,924,119	15,827,736	5,888,579	6,384,140	3,555,017					202.3
Oklahoma	16,588,104	8,630,717	4,333,580	3,158,879	1,053,108			85,150		301.4
Oregon	13,534,555	8,136,254	4,146,096	3,521,116	410,234				58,808	272.2
Pennsylvania	43,049,247	21,457,955	10,070,000	4,698,455	6,689,500					138.7
Rhode Island	6,052,054	3,065,635	524,818	849,485	1,571,285				120,047	22.5
South Carolina	12,684,685	7,177,367	2,969,609	2,437,012	460,746				1,310,000	437.4
South Dakota	15,676,427	9,134,303	5,368,191	3,597,895	161,067				7,150	865.7
Tennessee	17,300,785	8,543,890	4,422,228	3,088,256	1,033,406					448.1
Texas	51,543,633	27,389,944	14,339,850	7,157,250	5,161,700				731,144	1,466.0
Utah	9,086,026	6,958,738	4,387,015	1,267,066	811,874		9,014		483,769	263.7
Vermont	4,047,376	2,095,986	836,675	1,135,720	50,054				73,537	60.5
Virginia	25,427,269	12,811,315	7,207,449	5,365,166	98,700				140,000	507.7
Washington	17,033,441	9,141,844	4,303,293	2,775,153	1,128,496				934,902	371.5
West Virginia	12,512,753	6,285,928	2,476,638	2,508,480	1,300,810					142.9
Wisconsin	29,236,560	14,513,514	5,424,798	4,522,265	4,566,451					581.5
Wyoming	7,756,739	5,096,397	3,087,990	1,567,625	440,782					207.9
District of Columbia	5,427,347	2,710,233	1,265,860	1,444,373						3.2
Hawaii	7,335,486	3,608,944	1,964,463	570,740	1,052,741				21,000	19.7
Puerto Rico	7,792,135	3,778,227	1,186,864	892,253	1,699,110					24.3
Total	986,020,271	512,570,311	239,958,217	150,760,166	111,704,755	143,970	50,962	409,525	9,542,716	20,462.5

[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.

Table 7.—*Status of projects as of June 30, 1952, and projects completed during the fiscal year* [1]

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	$35, 523, 342	$17, 882, 491	553. 3	$8, 818, 566	$4, 827, 663	192. 1	$21, 749, 792	$10, 763, 941	428. 5	$10, 418, 656	$5, 306, 589	443. 6
Arizona	4, 223, 440	2, 795, 707	130. 4	1, 193, 715	715, 812	81. 3	10, 162, 630	7, 005, 343	225. 8	7, 921, 672	5, 617, 168	127. 7
Arkansas	10, 277, 654	5, 461, 057	285. 9	7, 575, 264	3, 751, 481	213. 8	17, 476, 864	8, 874, 829	494. 7	13, 254, 513	6, 579, 825	389. 0
California	20, 994, 364	6, 419, 638	156. 5	19, 697, 269	9, 792, 985	95. 6	87, 016, 835	42, 313, 664	272. 4	41, 421, 463	20, 496, 995	320. 3
Colorado	7, 316, 939	4, 816, 448	305. 9	3, 630, 870	1, 918, 803	73. 5	15, 397, 445	8, 381, 502	393. 9	13, 858, 652	7, 608, 832	342. 4
Connecticut	2, 104, 046	1, 101, 875	5. 8	2, 161, 458	1, 054, 923	9. 0	10, 545, 880	5, 578, 631	16. 4	5, 981, 081	3, 117, 210	11. 4
Delaware	335, 000	165, 000	1. 7	2, 022, 923	1, 011, 462	7. 9	6, 160, 386	2, 718, 519	49. 9	3, 999, 176	1, 943, 767	17. 6
Florida	17, 853, 692	9, 187, 546	305. 2	8, 179, 664	4, 363, 694	133. 0	15, 168, 940	7, 700, 209	270. 8	19, 726, 052	9, 542, 203	432. 3
Georgia	19, 398, 327	10, 128, 234	494. 1	10, 783, 487	5, 982, 886	122. 7	35, 043, 777	16, 849, 736	582. 1	22, 465, 530	11, 671, 680	527. 3
Idaho	8, 220, 202	5, 122, 213	228. 5	3, 458, 899	2, 246, 675	55. 3	7, 103, 408	4, 653, 790	175. 8	9, 177, 755	5, 122, 496	362. 4
Illinois	51, 286, 677	28, 391, 679	462. 8	17, 988, 358	9, 017, 279	205. 8	83, 243, 422	41, 969, 856	715. 7	34, 005, 978	17, 597, 061	374. 2
Indiana	40, 169, 502	20, 343, 226	259. 4	7, 764, 187	4, 445, 339	161. 9	29, 343, 065	15, 586, 496	333. 7	16, 465, 384	7, 850, 994	193. 5
Iowa	12, 869, 885	6, 867, 592	358. 8	10, 676, 999	5, 429, 097	448. 3	20, 339, 311	10, 123, 090	885. 5	19, 355, 172	10, 012, 130	589. 8
Kansas	10, 815, 856	5, 255, 968	1, 017. 4	5, 349, 390	2, 691, 189	524. 9	17, 140, 883	8, 926, 003	563. 1	14, 529, 242	7, 237, 206	995. 5
Kentucky	21, 156, 753	11, 257, 477	416. 0	7, 120, 169	3, 483, 332	135. 0	17, 277, 688	9, 329, 134	344. 0	16, 759, 901	8, 314, 357	310. 6
Louisiana	15, 520, 330	7, 445, 615	115. 3	10, 942, 780	4, 995, 870	31. 5	20, 917, 080	10, 437, 231	216. 5	17, 404, 913	8, 851, 550	216. 2
Maine	10, 935, 031	5, 788, 613	100. 8	1, 288, 200	854, 370	7. 4	11, 823, 652	6, 930, 046	87. 7	6, 683, 124	3, 567, 650	66. 1
Maryland	9, 920, 354	4, 558, 968	71. 4	1, 710, 783	862, 150	68. 4	11, 002, 305	6, 284, 475	25. 7	9, 812, 313	4, 254, 913	92. 1
Massachusetts	4, 861, 268	2, 558, 584	18. 1	9, 443, 966	4, 486, 193	8. 4	48, 027, 080	23, 601, 267	47. 4	38, 282, 359	19, 328, 514	41. 9
Michigan	29, 892, 793	15, 105, 968	495. 8	11, 718, 634	5, 857, 505	240. 8	59, 152, 310	26, 035, 988	350. 9	24, 618, 314	12, 259, 199	617. 5
Minnesota	9, 642, 462	5, 174, 990	1, 127. 9	9, 339, 614	4, 673, 771	723. 0	28, 368, 842	15, 383, 039	999. 2	19, 591, 507	10, 341, 940	1, 059. 3
Mississippi	17, 375, 272	8, 966, 224	560. 0	5, 889, 220	2, 913, 372	187. 9	16, 499, 131	8, 627, 800	468. 4	11, 861, 775	5, 909, 548	425. 0
Missouri	27, 714, 279	14, 083, 734	896. 5	15, 010, 628	7, 504, 489	253. 0	40, 844, 883	21, 421, 508	659. 5	20, 075, 156	10, 179, 993	651. 5
Montana	9, 306, 470	5, 519, 098	292. 7	4, 669, 096	2, 721, 442	71. 0	21, 051, 428	12, 664, 245	352. 2	8, 313, 674	4, 928, 306	302. 5
Nebraska	12, 026, 488	6, 310, 594	583. 1	5, 936, 788	2, 947, 759	156. 0	19, 145, 302	9, 493, 954	601. 6	9, 553, 878	5, 279, 899	270. 9
Nevada	7, 338, 367	5, 830, 813	250. 6	201, 264	172, 190	57. 2	6, 061, 388	5, 074, 741	270. 3	4, 080, 958	3, 238, 931	231. 3
New Hampshire	5, 416, 067	2, 847, 534	28. 7	615, 108	310, 944	5. 2	6, 935, 074	3, 456, 787	46. 9	3, 483, 279	1, 709, 651	38. 0
New Jersey	10, 335, 965	5, 085, 965	46. 1	8, 505, 716	4, 254, 358	14. 4	30, 967, 204	15, 316, 040	25. 4	12, 897, 858	6, 119, 010	33. 3
New Mexico	4, 697, 506	3, 035, 527	152. 1	3, 269, 065	2, 164, 743	110. 9	13, 493, 301	8, 620, 003	306. 6	9, 117, 885	5, 906, 731	277. 7
New York	96, 317, 718	50, 035, 760	205. 2	32, 119, 808	15, 115, 954	182. 5	108, 522, 138	49, 617, 921	400. 0	60, 319, 268	28, 976, 732	310. 6
North Carolina	24, 732, 630	12, 005, 325	438. 2	5, 928, 517	2, 830, 665	142. 7	24, 231, 905	11, 749, 298	465. 2	21, 722, 199	10, 484, 691	521. 7
North Dakota	7, 786, 286	4, 025, 157	1, 116. 8	8, 678, 801	4, 431, 168	783. 5	10, 200, 933	5, 120, 585	796. 4	12, 165, 053	6, 036, 768	1, 299. 8

Ohio	36,916,202	18,324,843	127.9	16,590,742	8,524,323	58.4	77,697,681	39,255,415	246.3	37,546,443	18,728,034	398.5
Oklahoma	15,943,774	8,821,712	224.9	7,398,170	3,883,814	169.3	23,879,603	12,634,119	263.4	16,910,146	8,467,542	451.0
Oregon	2,421,845	1,433,000	27.1	3,384,938	2,019,058	87.4	17,958,732	10,243,768	238.9	12,011,468	6,826,253	243.9
Pennsylvania	38,221,714	19,103,357	122.5	24,397,036	12,160,098	43.7	73,733,195	36,609,495	198.9	49,206,959	24,199,554	151.3
Rhode Island	4,355,410	2,177,705	35.0	2,380,262	1,190,131	8.2	17,466,188	9,151,344	25.0	4,574,966	2,342,491	15.8
South Carolina	10,769,037	6,012,853	341.7	4,206,948	2,236,935	223.5	20,157,249	12,282,064	405.3	5,862,502	3,110,981	214.8
South Dakota	8,609,184	5,157,750	671.8	4,186,188	2,439,566	246.6	13,906,177	8,053,167	774.1	11,611,284	6,894,219	748.2
Tennessee	12,178,116	5,803,158	408.3	13,581,314	6,500,787	351.3	30,336,392	14,437,032	444.2	12,521,626	6,182,504	429.1
Texas	7,196,700	3,752,250	165.2	18,104,940	10,932,521	465.5	59,944,182	31,391,311	1,071.8	47,735,387	22,239,744	1,100.0
Utah	5,716,331	4,459,838	274.5	2,403,692	1,996,603	169.4	9,441,171	7,226,820	300.2	4,935,253	3,546,566	174.8
Vermont	4,903,190	2,635,845	46.1	691,085	389,436	12.0	6,971,915	3,495,104	56.5	1,514,061	729,865	29.5
Virginia	20,649,212	10,418,661	328.2	6,780,597	3,399,390	131.3	27,024,014	14,172,606	386.8	15,818,427	7,789,483	415.0
Washington	12,811,997	6,353,669	177.6	3,162,756	1,707,648	102.4	19,026,151	9,916,165	189.8	20,108,449	9,688,680	258.8
West Virginia	12,956,887	6,539,049	104.5	4,494,119	2,271,456	48.6	14,195,223	7,075,464	135.3	7,402,938	3,790,132	101.2
Wisconsin	22,637,139	12,014,046	436.5	9,757,149	4,445,061	223.8	31,896,397	16,132,761	474.4	18,363,391	8,966,146	554.2
Wyoming	3,224,180	2,109,230	99.0	1,655,752	1,098,119	63.7	9,306,328	6,136,924	159.8	7,561,597	4,622,788	278.9
Alaska	36,000	36,000	4.5									
District of Columbia	13,459,494	5,908,747	1.4	2,654,245	1,323,772	.5	3,027,796	1,707,139		1,221,614	610,216	4.0
Hawaii	5,272,230	2,595,890	9.6	2,495,440	1,235,345	10.7	11,112,678	4,510,259	21.3	4,655,959	2,146,032	27.8
Puerto Rico	6,467,038	3,068,136	39.2	3,842,120	1,845,365	18.7	10,753,853	5,079,714	31.2	4,386,927	2,013,175	18.6
Total	811,110,645	420,300,359	15,126.5	383,856,699	197,428,991	7,938.9	1,348,249,207	690,120,252	17,295.4	823,273,137	418,286,944	17,508.4

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

Table 8.—*Status of projects as of June 30, 1952, and projects completed during the fiscal year,[1] on Federal-aid rural primary system*

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	$27,604,700	$14,036,970	276.1	$2,962,690	$1,542,116	21.2	$11,779,793	$6,049,960	110.4	$3,050,371	$1,573,256	46.4
Arizona	1,345,679	773,000	20.8	475,428	179,000	8.2	7,034,629	4,642,116	94.4	4,254,239	3,010,290	54.0
Arkansas	6,751,126	3,377,923	131.6	3,866,180	1,887,195	56.5	10,690,530	5,552,626	208.9	6,345,242	3,172,650	143.4
California	5,058,000	1,942,691	8.2	3,038,304	1,530,519	13.2	26,244,400	11,496,140	65.9	13,909,985	6,831,987	93.8
Colorado	2,090,917	1,166,157	43.5	2,331,433	1,208,196	36.2	9,087,781	5,030,630	234.3	7,489,697	4,194,878	148.0
Connecticut	742,054	421,027		1,543,391	758,300	7.4	2,953,422	1,674,090	5.3	669,273	327,522	4.5
Delaware				2,022,923	1,011,461	8.0	3,613,293	1,401,922	19.5	2,252,111	1,129,165	7.6
Florida	7,873,402	3,972,701	123.5	2,306,926	1,168,514	35.9	7,807,098	4,006,780	81.1	7,025,329	3,521,941	129.7
Georgia	11,537,199	6,033,510	132.6	4,703,974	2,431,267	49.0	14,431,219	7,177,348	125.9	5,803,120	3,017,673	85.1
Idaho	6,311,279	3,925,341	116.9	2,443,201	1,584,240	18.5	2,967,896	1,956,770	51.1	6,221,290	3,207,051	186.4
Illinois	8,204,340	4,415,570	67.6	4,701,823	2,358,715	49.9	40,397,351	20,173,221	476.3	11,242,300	5,898,322	162.7
Indiana	16,212,494	8,126,447	67.4	2,312,680	1,178,346	44.2	16,032,510	8,017,555	199.3	6,751,711	3,367,799	111.4
Iowa	1,790,226	1,043,313	17.9	4,910,347	2,531,635	76.0	9,298,373	4,635,079	264.0	10,085,618	5,057,582	201.9
Kansas	4,623,474	2,113,667	130.0	1,431,538	731,690	34.3	11,347,713	5,669,935	217.8	9,103,168	4,560,309	253.4
Kentucky	9,037,752	4,668,876	129.0	1,387,960	736,027	3.6	9,499,228	4,851,706	137.5	8,349,906	4,148,729	116.4
Louisiana	9,781,444	4,769,772	59.7	1,943,000	945,840	20.2	13,205,974	6,581,994	105.6	7,081,767	3,524,133	87.7
Maine	3,662,230	1,907,935	28.9	858,600	550,100	4.7	3,837,845	1,963,073	25.2	3,269,266	1,768,090	29.9
Maryland	5,625,250	2,497,076	18.7	58,730	29,365		6,744,462	3,713,527	18.7	4,216,822	1,817,843	14.4
Massachusetts	148,220	77,060		1,637,080	814,026	2.4	9,795,292	4,874,239	11.6	719,371	312,282	
Michigan	12,688,568	6,274,778	94.2	5,693,700	2,843,100	56.7	10,320,750	5,402,425	131.9	8,071,390	4,183,712	137.9
Minnesota	1,932,362	1,181,931	46.8	3,647,000	1,826,000	71.2	12,869,948	6,593,987	328.9	11,368,707	5,595,566	296.6
Mississippi	10,133,266	5,420,432	180.7	3,287,488	1,644,344	74.7	8,143,410	4,423,960	213.7	5,144,657	2,570,050	165.1
Missouri	12,580,932	6,442,466	102.1	3,534,692	1,767,346	30.0	17,894,021	9,162,181	147.9	13,849,058	7,084,875	172.9
Montana	4,706,542	2,873,402	88.7	2,707,735	1,541,407	27.5	12,127,360	7,254,966	162.5	5,079,766	2,997,495	124.5
Nebraska	4,957,344	2,480,272	182.0	2,266,250	1,137,154	54.2	12,874,565	6,338,586	375.1	4,581,828	2,293,719	154.5
Nevada	4,549,884	3,494,925	109.6				3,720,597	3,097,078	87.8	1,249,889	996,287	50.1
New Hampshire	1,920,000	957,500	5.8	32,736	16,368		4,120,542	2,053,030	27.7	1,278,223	628,703	10.8
New Jersey	216,603	90,743	1.1	3,791,260	1,895,630	6.8	6,843,282	3,365,617	11.9	5,220,092	2,598,903	10.6
New Mexico	1,514,812	969,480	38.1	1,072,624	686,496	17.9	6,245,755	3,997,985	140.2	5,131,545	3,278,952	75.2
New York	21,676,080	10,793,040	75.2	12,989,678	5,912,516	122.2	27,984,707	13,075,964	193.4	22,565,257	10,471,622	204.4
North Carolina	10,327,270	4,972,635	183.8	2,140,730	1,003,994	11.2	12,819,899	5,998,717	136.8	9,696,967	4,604,503	145.7
North Dakota	1,203,357	732,333	38.5	5,132,822	2,654,643	254.5	5,476,919	2,753,601	254.3	5,861,474	2,900,520	378.5

Ohio	3,775,492	2,037,386	18.5	9,466,691	4,920,794	24.1	29,213,785	14,779,583	118.6	20,710,021	10,427,492	138.8
Oklahoma	7,222,997	3,877,465	87.8	3,724,930	1,945,076	55.9	11,496,812	6,052,132	131.5	8,620,697	4,491,466	166.0
Oregon	850,000	506,000	6.4	1,292,562	772,000	11.4	8,206,009	4,543,807	107.8	5,164,622	2,941,234	69.7
Pennsylvania	6,604,988	3,302,494	10.5	5,226,266	2,613,133	1.6	18,647,036	9,323,518	42.9	12,214,256	6,085,227	48.3
Rhode Island	1,459,060	729,530	3.5	2,076,638	1,038,319	7.1	1,198,698	639,108	3.7	179,345	89,673	----------
South Carolina	6,006,628	3,382,821	49.5	935,868	678,650	15.4	7,918,028	4,005,206	62.9	1,967,740	1,113,440	17.0
South Dakota	2,613,101	1,568,274	111.0	2,259,828	1,328,261	91.9	7,007,844	3,996,830	218.8	6,657,899	3,904,682	330.3
Tennessee	3,771,310	1,671,155	23.9	4,310,926	2,129,713	34.3	13,476,202	6,446,033	109.3	5,196,594	2,562,103	58.2
Texas	4,134,200	2,167,100	28.3	5,983,717	3,454,517	75.7	18,992,845	9,563,050	331.9	19,645,046	10,199,012	417.5
Utah	875,000	659,574	12.4	1,173,192	986,929	5.2	5,783,508	4,274,952	91.3	1,851,824	1,329,891	37.9
Vermont	2,414,239	1,391,370	16.8	90,063	52,569	----------	4,173,717	2,069,515	26.6	541,086	255,475	8.8
Virginia	5,658,441	2,947,441	44.9	2,914,567	1,455,674	24.2	15,710,762	7,871,128	133.6	8,079,098	3,997,831	175.2
Washington	4,739,000	2,437,600	45.3	757,010	386,636	10.4	8,214,406	4,189,257	73.0	5,737,499	2,351,921	57.9
West Virginia	5,860,716	2,939,326	26.6	2,429,169	1,216,912	26.4	4,930,898	2,459,449	33.7	2,826,864	1,401,432	13.5
Wisconsin	13,292,077	6,892,538	110.8	2,329,032	1,017,097	34.5	15,373,782	7,498,823	207.3	6,437,137	3,131,564	160.3
Wyoming	1,061,357	700,481	9.5	984,012	647,487	32.9	5,665,767	3,670,153	85.9	4,747,735	2,841,217	99.1
Hawaii	2,226,616	1,077,058	3.3	268,810	134,405	5.1	2,912,332	1,439,761	11.0	3,053,675	1,502,568	20.5
Puerto Rico	1,765,090	811,162	6.6	2,329,183	1,112,421	7.1	2,301,463	1,117,663	7.0	823,006	390,578	5.0
Total	291,137,118	151,051,748	3,134.6	139,785,387	71,996,143	1,679.5	539,434,458	276,926,776	6,461.7	331,393,583	169,663,215	5,627.5

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

[2] Initial commitment of funds.

Table 9.—*Status of projects as of June 30, 1952, and projects completed during the fiscal year,[1] on secondary roads in rural areas*

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	$6,780,212	$3,317,306	275.0	$3,405,806	$1,626,546	169.3	$6,215,346	$2,970,874	302.2	$5,937,143	$2,855,735	390.5
Arizona	2,287,761	1,604,707	106.4	476,406	390,153	71.9	2,409,175	1,857,521	126.2	2,415,458	1,716,074	60.2
Arkansas	1,800,772	906,706	147.3	2,990,634	1,511,061	150.8	6,174,558	3,016,315	282.8	4,837,274	2,418,706	224.7
California	7,412,123	3,947,527	140.8	3,508,746	1,768,343	72.8	10,051,493	5,055,957	158.0	9,312,249	4,783,168	209.7
Colorado	4,426,879	3,205,094	262.0	1,054,466	574,728	37.2	4,275,860	2,417,015	156.8	3,718,846	2,079,775	190.4
Connecticut	221,656	110,828	1.0	109,837	54,917	.1	1,602,400	767,863	3.5	511,476	252,164	3.2
Delaware	335,000	165,000	1.7				2,440,521	1,264,092	30.3	1,275,852	610,490	7.6
Florida	4,335,290	2,249,845	169.2	2,827,822	1,667,140	86.5	4,389,290	2,116,949	179.6	6,096,552	2,579,680	279.8
Georgia	7,547,128	3,946,724	361.5	1,341,002	727,425	52.6	11,067,970	5,531,939	445.4	8,671,131	4,577,971	431.6
Idaho	1,903,338	1,193,378	111.7	1,008,015	655,520	36.8	3,685,259	2,415,390	122.4	2,189,365	1,386,903	173.7
Illinois	10,175,627	5,116,398	368.5	3,530,476	1,695,122	140.1	6,283,591	3,099,791	146.5	3,388,685	1,662,920	137.3
Indiana	10,168,598	5,022,524	169.8	2,919,163	1,480,999	100.9	4,542,465	2,053,336	77.0	5,500,823	2,381,644	65.2
Iowa	5,298,733	2,658,816	315.1	4,881,104	2,437,140	357.7	7,372,705	3,678,889	585.8	4,955,390	2,459,654	370.6
Kansas	5,910,982	2,957,351	887.0	3,349,930	1,672,788	488.9	3,082,996	1,542,256	340.6	4,212,573	2,076,329	737.5
Kentucky	7,539,090	3,781,145	276.2	3,293,401	1,648,901	118.9	6,736,588	3,738,169	204.8	6,541,745	3,260,003	184.0
Louisiana	3,741,176	1,701,988	52.7	2,077,100	959,180	9.3	5,386,010	2,692,690	94.5	7,840,049	4,051,731	104.9
Maine	4,889,801	2,569,678	67.0	426,600	302,770	2.8	5,891,271	3,929,078	55.1	2,165,383	1,137,857	27.8
Maryland	4,209,466	2,019,073	52.4	1,519,935	766,726	67.8	411,631	246,092	3.9	1,662,336	852,148	71.3
Massachusetts	2,214,016	1,232,008	17.9	410,308	185,154	2.3	2,600,899	1,261,995	16.2	555,626	271,351	3.8
Michigan	8,947,072	4,725,164	401.6	3,259,194	1,635,075	179.9	6,625,895	3,353,957	190.0	8,652,379	4,297,343	447.9
Minnesota	6,001,031	3,096,024	1,069.8	4,959,937	2,502,687	648.6	6,003,644	3,071,637	601.9	5,549,351	2,826,221	759.5
Mississippi	6,804,632	3,327,105	377.8	2,076,638	1,035,681	112.0	6,593,221	3,322,590	252.0	4,473,504	2,217,690	235.1
Missouri	10,794,559	5,408,720	790.2	3,706,326	1,852,338	222.4	7,804,883	4,038,082	504.7	4,179,025	2,072,859	458.2
Montana	4,599,927	2,645,696	204.0	1,804,227	1,090,439	41.9	6,649,378	3,900,715	185.0	2,835,809	1,586,072	176.3
Nebraska	5,643,982	3,100,841	395.6	2,196,894	1,131,606	101.8	5,722,682	2,874,576	224.5	2,774,257	1,426,478	114.4
Nevada	2,620,274	2,194,357	140.3	201,264	172,190	57.2	1,841,472	1,567,746	179.7	2,286,295	1,816,725	171.8
New Hampshire	1,271,000	635,000	12.8	538,752	272,766	5.2	1,936,927	961,717	17.9	1,914,117	939,709	25.4
New Jersey	3,689,899	1,813,044	40.4	1,356,496	678,248	.8	540,450	256,495	3.2	72,642	36,308	11.5
New Mexico	2,766,797	1,799,550	112.0	1,745,050	1,095,635	87.0	3,364,204	2,141,338	139.0	3,305,601	2,199,260	196.8
New York	10,475,542	5,748,271	77.9	5,002,660	2,302,468	49.1	16,092,355	7,359,735	142.8	3,752,494	1,582,447	59.5
North Carolina	8,711,360	4,279,690	241.7	3,618,240	1,743,605	130.9	8,291,436	4,175,821	302.4	7,671,365	3,824,150	340.4
North Dakota	6,577,129	3,289,924	1,078.3	3,522,936	1,761,793	528.9	3,681,728	1,845,841	539.3	6,267,719	3,103,974	921.4

Ohio	9,353,480	4,834,592	97.2	2,435,274	1,272,083	30.4	13,777,727	6,989,276	105.8	7,339,482	3,684,693	235.6
Oklahoma	3,960,758	2,317,708	121.2	3,472,420	1,824,676	113.3	4,393,056	2,245,060	111.2	7,203,497	3,363,402	272.6
Oregon	879,345	541,000	20.2	2,092,377	1,247,058	76.0	7,107,390	4,097,401	121.4	4,269,503	2,473,539	172.4
Pennsylvania	10,030,396	5,007,698	106.1	3,060,874	1,530,437	30.3	12,735,842	6,193,182	126.4	8,621,917	4,303,385	84.1
Rhode Island	2,720,350	1,360,175	31.1	211,166	105,583	1.1	376,356	179,428	2.6	775,496	384,474	5.1
South Carolina	3,452,971	1,933,453	288.0	2,905,960	1,377,485	206.2	7,995,202	5,955,181	325.4	2,544,746	1,239,496	188.2
South Dakota	5,386,083	3,246,976	557.2	1,525,129	886,058	153.0	6,885,726	4,049,261	554.9	4,212,441	2,396,014	406.9
Tennessee	6,681,806	3,344,503	383.6	5,174,996	2,590,878	316.9	7,453,488	3,714,744	308.0	5,792,874	2,895,922	365.7
Texas	2,928,100	1,517,950	136.9	5,757,308	2,900,265	376.1	9,150,839	4,653,600	637.0	9,916,044	4,891,179	585.1
Utah	3,991,331	3,086,434	258.3	863,433	737,934	164.1	2,558,994	2,139,993	200.4	3,013,201	2,165,205	136.9
Vermont	1,948,351	974,176	26.0	589,168	330,941	12.0	2,740,571	1,375,536	29.8	786,688	378,717	20.0
Virginia	7,984,565	4,208,073	262.5	2,761,794	1,391,818	104.7	10,752,422	6,021,145	251.8	5,793,961	2,873,553	231.2
Washington	3,319,197	1,893,575	129.7	1,509,759	783,992	91.3	5,147,145	2,694,305	98.4	7,855,923	3,908,108	193.9
West Virginia	5,102,545	2,602,910	77.7	1,645,757	844,832	20.1	4,238,090	2,112,245	95.7	3,148,132	1,678,605	87.1
Wisconsin	5,867,944	2,827,849	316.7	4,241,578	1,898,264	180.7	7,097,528	3,433,102	257.5	6,305,064	3,067,011	344.3
Wyoming	2,162,823	1,408,749	89.5	561,047	374,034	29.8	2,739,749	1,778,632	72.4	2,813,862	1,781,571	179.8
Alaska	36,000	36,000	4.5									
Hawaii	2,895,754	1,449,902	6.1	385,110	192,555	5.1	2,101,670	1,061,335	8.9	1,100,345	423,548	6.8
Puerto Rico	2,934,948	1,423,974	29.7	1,262,470	610,158	11.6	1,883,430	886,041	18.6	387,627	192,616	1.2
Total	251,737,599	133,785,179	11,667.8	113,574,985	58,298,195	6,055.1	278,903,528	148,105,928	9,940.2	217,403,317	111,504,577	11,108.9

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

[2] Initial commitment of funds.

Table 10.—*Status of projects as of June 30, 1952, and projects completed during the fiscal year,[1] in urban areas*

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	$1,138,430	$528,215	2.2	$2,450,070	$1,659,001	1.7	$3,754,653	$1,743,107	15.9	$1,431,142	$877,597	6.7
Arizona	590,000	418,000	3.2	241,880	146,658	1.1	718,826	505,705	5.1	1,251,976	890,804	13.6
Arkansas	1,725,756	1,176,428.	7.1	718,450	353,225	6.4	611,776	305,888	3.0	2,071,996	988,469	20.9
California	8,524,241	529,420	7.5	13,150,219	6,494,123	9.6	50,720,941	25,761,568	48.5	18,199,230	8,881,840	16.8
Colorado	799,143	445,197	.4	244,971	135,880		2,033,805	933,857	2.8	2,650,110	1,334,178	4.0
Connecticut	1,140,336	570,020	4.8	508,231	241,705	1.6	5,990,058	3,136,678	7.6	4,800,331	2,537,524	3.7
Delaware							106,572	52,504		471,213	204,113	2.3
Florida	5,645,000	2,965,000	12.5	3,044,916	1,528,040	10.6	2,972,552	1,576,480	10.2	6,604,170	3,440,582	22.9
Georgia	314,000	148,000		4,738,511	2,824,194	21.2	9,544,587	4,140,449	10.8	7,991,279	4,076,036	10.6
Idaho	5,585	3,494		7,684	6,916		450,252	281,630	2.2	767,100	528,542	2.3
Illinois	32,906,711	18,859,711	26.8	9,756,058	4,963,442	15.8	36,562,481	18,696,844	92.8	19,374,993	10,035,819	74.2
Indiana	13,788,410	7,194,255	22.3	2,532,344	1,785,995	16.9	8,768,090	5,515,515	57.4	4,212,850	2,101,552	16.9
Iowa	5,780,926	3,165,463	25.9	885,547	460,322	14.5	3,668,233	1,809,122	35.8	4,314,163	2,494,894	17.8
Kansas	281,400	184,950	.4	567,922	286,711	1.7	2,710,174	1,713,812	4.7	1,213,501	600,568	4.6
Kentucky	4,579,911	2,807,456	10.8	2,438,808	1,098,404	12.5	1,041,872	739,259	1.7	1,868,250	905,625	10.2
Louisiana	1,997,710	973,855	3.0	6,922,680	3,090,850	1.9	2,325,096	1,162,548	16.4	2,483,097	1,275,686	23.6
Maine	2,383,000	1,311,000	4.8	3,000	1,500		2,094,536	1,037,895	7.3	1,248,474	601,702	8.4
Maryland	85,638	42,819	.3	132,118	66,059	.7	3,846,212	2,324,856	3.2	3,933,155	1,584,921	6.4
Massachusetts	2,499,032	1,249,516	.3	7,396,578	3,487,013	3.7	35,630,889	17,465,032	19.6	37,007,361	18,744,881	38.1
Michigan	8,257,153	4,106,026		2,765,740	1,379,330	4.3	42,205,665	17,279,606	29.0	7,894,545	3,778,144	31.7
Minnesota	1,709,069	897,034	11.3	732,677	345,083	3.2	9,495,251	5,717,415	68.5	2,673,449	1,920,154	3.2
Mississippi	437,374	218,687	1.4	525,094	233,347	1.3	1,762,500	881,250	2.8	2,243,613	1,121,807	24.7
Missouri	4,338,788	2,232,548	4.2	7,769,610	3,884,805	.6	15,145,979	8,221,246	6.8	2,047,073	1,022,259	20.4
Montana				157,134	89,596	1.6	2,274,689	1,508,564	4.6	398,100	344,739	1.7
Nebraska	1,425,162	729,481	5.5	1,473,644	679,000		548,056	280,791	2.0	2,197,794	1,559,703	2.1
Nevada	168,209	141,531	.7				499,319	409,917	2.7	544,773	425,919	9.4
New Hampshire	2,225,067	1,255,034	10.0	43,620	21,810		877,605	442,039	1.2	290,939	141,240	1.8
New Jersey	6,429,463	3,182,178	4.5	3,357,960	1,680,480	6.8	23,583,472	11,693,928	10.4	7,605,123	3,483,800	11.2
New Mexico	415,897	266,497	2.1	451,392	382,612	6.0	3,883,342	2,480,681	27.4	680,739	428,518	5.6
New York	64,166,096	33,494,449	52.1	14,127,470	6,900,970	11.2	64,445,076	29,182,223	63.8	34,001,518	16,922,664	46.6
North Carolina	5,694,000	2,753,000	12.6	169,547	83,066	.6	3,120,570	1,574,760	26.0	4,353,867	2,056,038	35.6
North Dakota	5,800	2,900		23,043	14,732	.1	1,042,286	521,143	2.8	35,860	32,274	

Ohio	23,787,230	11,452,865	12.2	4,688,777	2,331,446	3.9	34,706,169	17,486,557	21.9	9,496,940	4,615,849	24.2
Oklahoma	4,760,018	2,626,539	15.9	200,820	114,061	.1	7,989,736	4,336,927	20.7	1,085,952	612,673	12.4
Oregon	692,500	386,000	.5				2,645,334	1,602,560	9.8	2,577,343	1,411,480	1.8
Pennsylvania	21,586,330	10,793,165	5.9	16,109,896	8,016,528	11.7	42,350,317	21,092,795	29.6	28,370,787	13,810,942	18.9
Rhode Island	176,000	88,000	.4	92,458	46,229		15,891,133	8,332,808	18.7	3,620,125	1,868,344	10.7
South Carolina	1,309,439	696,579	4.1	365,120	180,800	1.8	4,244,019	2,321,677	17.1	1,350,017	758,045	9.6
South Dakota	610,000	342,500	3.6	401,230	225,248	1.6	12,607	7,076	.5	740,943	593,523	10.9
Tennessee	1,725,000	787,500	.8	4,095,392	1,780,196		9,406,702	4,276,255	26.9	1,532,159	724,479	5.2
Texas	134,400	67,200		6,363,915	4,577,739	13.7	31,800,498	17,174,661	103.0	18,174,297	7,149,554	97.4
Utah	850,000	713,830	3.8	367,066	271,740		1,098,669	811,875	8.4	70,228	51,470	
Vermont	540,600	270,300	3.4	11,854	5,926		57,626	50,054	.1	186,287	95,673	.7
Virginia	7,006,296	3,263,147	20.7	1,104,236	551,898	2.4	560,830	280,333	1.4	1,945,368	918,099	8.6
Washington	4,753,800	2,022,494	2.5	895,987	537,020	.7	5,664,601	3,032,602	18.3	6,515,027	3,428,651	7.0
West Virginia	1,993,626	996,813	.2	419,193	209,712	2.1	5,026,235	2,503,770	5.9	1,427,942	710,095	.6
Wisconsin	3,477,118	2,293,659	8.9	3,186,540	1,529,700	8.6	9,425,087	5,200,836	9.6	5,621,191	2,767,570	49.6
Wyoming				110,693	76,598	1.0	900,812	688,139	1.6			
District of Columbia	13,459,494	5,908,747	1.4	2,654,245	1,323,773	.5	3,027,796	1,707,139		1,221,614	610,216	4.0
Hawaii	149,860	68,930	.2	1,841,520	908,385	.6	6,098,676	2,009,163	1.4	501,939	219,916	.6
Puerto Rico	1,767,000	833,000	2.9	250,467	122,785		6,568,959	3,076,009	5.6	3,176,294	1,429,981	12.3
Total	268,235,928	135,463,432	324.1	130,496,327	67,134,653	204.3	529,911,221	265,087,548	893.5	274,476,237	137,119,152	772.0

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

[2] Initial commitment of funds.

Table 11.—*Interstate system improvements financed with Federal-aid funds: Status of projects as of June 30, 1952, and projects completed during the fiscal year*

State or Territory	Programed,[1] 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	$11, 922, 000	$6, 036, 000	88. 0	$2, 239, 080	$1, 131, 840	4. 9	$6, 645, 380	$3, 297, 856	33. 6	$360, 144	$226, 388	2. 8
Arizona	1, 445, 679	844, 000	21. 8	475, 428	179, 000	8. 2	4, 843, 721	3, 141, 498	67. 0	3, 477, 395	2, 479, 395	53. 2
Arkansas	3, 766, 226	1, 883, 113	55. 8	1, 160, 160	578, 456	15. 9	3, 374, 410	1, 904, 076	53. 8	1, 586, 030	744, 555	23. 2
California	1, 716, 800	214, 893	2. 1	7, 742, 391	4, 027, 000	6. 9	45, 452, 441	21, 624, 750	68. 5	20, 014, 719	9, 811, 496	67. 1
Colorado	2, 238, 164	1, 266, 786	34. 1	800, 796	448, 560	8. 1	4, 819, 656	2, 530, 538	35. 9	4, 563, 168	2, 420, 013	31. 2
Connecticut	650, 000	325, 000	2. 0	1, 727, 955	838, 877	7. 7	4, 913, 284	2, 613, 758	7. 3	4, 328, 319	2, 079, 559	6. 4
Delaware							758, 914	379, 457	9. 9			
Florida	7, 808, 000	3, 888, 000	56. 7	2, 018, 402	1, 011, 830	17. 6	3, 393, 354	1, 786, 881	32. 3	4, 647, 964	2, 572, 845	54. 1
Georgia	3, 278, 626	1, 698, 113	16. 0	5, 775, 508	2, 824, 219	29. 8	11, 982, 379	5, 184, 214	38. 9	7, 846, 619	3, 551, 391	14. 8
Idaho	1, 989, 659	1, 246, 364	29. 9	1, 536. 397	966, 329	15. 1	1, 602, 990	994, 790	18. 4	1, 893, 151	1, 201, 560	47. 0
Illinois	25, 359, 000	14, 462, 750	11. 5	8, 213, 300	4, 125, 770	14. 6	37, 046, 848	18, 863, 955	139. 0	18, 455, 436	9, 666, 778	70. 9
Indiana	12, 413, 000	5, 940, 000	28. 2	541, 074	280, 167	1. 1	7, 365, 904	4, 439, 289	15. 3	2, 873, 325	1, 450, 603	9. 2
Iowa							39, 647	18, 575	.2	655, 918	1, 299, 733	2. 1
Kansas	669, 700	337, 930	9. 5	449, 742	227, 671	7. 2	4, 245, 160	2, 122, 580	47. 4	2, 339, 119	2, 172, 821	49. 9
Kentucky	3, 970, 000	2, 147, 500	24. 6	733, 699	366, 849	6. 1	3, 731, 277	1, 864, 847	46. 5	4, 793, 533	1, 398, 713	58. 2
Louisiana	5, 970, 500	2, 864, 500	41. 0	2, 325, 780	873, 100	8. 8	6, 296, 140	3, 148, 070	56. 2	2, 327, 925	163, 960	26. 9
Maine	3, 775, 000	1, 988, 100	17. 3	532, 600	266, 300	4. 4	1, 315, 895	699, 405	4. 4	1, 748, 902	862, 886	14. 9
Maryland	4, 960, 000	2, 164, 451	11. 2				7, 752, 300	4, 325, 000	9. 7	1, 915, 000	3, 872, 500	2. 5
Massachusetts	1, 657, 000	828, 500	.3	7, 641, 180	3, 804, 800	6. 1	17, 973, 169	8, 668, 646	13. 3	7, 959, 848	3, 940, 148	2. 1
Michigan	11, 468, 250	5, 689, 150	21. 1	3, 541, 640	1, 767, 280	12. 9	37, 534, 885	14, 872, 750	4. 6	6, 929, 000	521, 162	24. 1
Minnesota	293, 500	146, 750	2. 8	621, 382	289, 357	3. 0	2, 067, 592	1, 151, 633	29. 7	2, 406, 065	1, 170, 795	43. 0
Mississippi	4, 142, 500	2, 422, 050	40. 5	1, 952, 800	977, 500	24. 1	2, 806, 450	1, 755, 700	16. 4	1, 519, 420	3, 759, 710	19. 7
Missouri	8, 866, 892	4, 410, 166	56. 5	8, 523, 808	4, 261, 904	7. 4	20, 190, 556	10, 255, 635	53. 3	7, 583, 721	1, 975, 385	63. 1
Montana	2, 065, 000	1, 323, 016	28. 1	612, 731	348, 901	.4	5, 703, 511	3, 265, 229	63. 9	1, 894, 256	105, 760	30. 6
Nebraska	378, 000	189, 000	15. 3	10, 300	3, 550		633, 752	316, 876	6. 2			
Nevada	1, 848, 591	1, 535, 221	12. 4				2, 873, 456	2, 378, 944	69. 1	577, 287	473, 244	17. 5
New Hampshire	1, 209, 000	748, 000	4. 0	8, 000	4, 000		507, 660	257, 153	.5			
New Jersey	734, 000	367, 000	2. 0	3, 849, 680	1, 924, 840	5. 8	7, 751, 200	3, 863, 450	10. 0	4, 459, 710	2, 104, 050	3. 5
New Mexico	915, 000	585, 600	26. 3	522, 222	334, 222	9. 7	4, 304, 610	2, 751, 893	59. 6	4, 858, 559	3, 098, 304	67. 2
New York	29, 254, 000	14, 287, 000	27. 7				19, 127, 678	8, 609, 051	35. 8	7, 214, 078	3, 277, 881	34. 1
North Carolina	3, 715, 000	1, 673, 830	29. 9	216, 020	108, 010		1, 198, 820	814, 665	19. 5	1, 907, 820	815, 830	12. 7
North Dakota				8, 025	7, 222		2, 084, 762	1, 042, 381	31. 4	35, 860	32, 274	

Ohio	17,612,000	8,089,000	18.1	3,639,718	1,810,344	8.3	12,900,422	5,561,306	3.4			
Oklahoma	3,757,000	1,983,740	15.1	70,500	26,628		4,237,220	2,357,641	10.7	2,939,820	1,490,471	20.5
Oregon	575,000	338,000	4.4	591,116	366,000	6.8	6,628,240	3,697,833	49.7	3,907,105	2,301,778	53.4
Pennsylvania	25,284,300	12,642,150	13.8	14,287,993	7,117,920	10.3	26,138,853	13,030,000	21.1	25,605,689	12,211,000	21.6
Rhode Island	450,000	225,000	.1	179,526	89,763		5,242,400	2,621,200	6.5	868,765	432,521	2.9
South Carolina	1,666,000	953,000	9.8	92,568	91,000	.1	5,409,713	2,723,143	43.8	200,400	100,200	1.2
South Dakota	983,000	551,757	23.3	55,034	30,895	1.9	2,332,760	1,309,405	42.1	1,320,085	741,490	58.3
Tennessee	2,782,000	1,144,000	1.1	3,611,654	1,538,327	7.9	8,374,848	3,976,856	44.5	2,122,918	1,079,676	20.9
Texas	1,108,800	554,400	14.8	4,897,630	2,616,187	35.9	21,367,400	11,137,200	127.4	17,721,427	8,773,850	126.9
Utah	1,250,000	1,015,350	8.9	1,446,158	1,199,796	4.5	3,020,539	2,241,639	27.1	805,950	588,435	30.9
Vermont	546,500	273,250	1.0				82,980	62,730	.1			
Virginia	1,428,000	646,000	8.1	545,357	272,610	2.7	3,666,319	1,828,289	18.5	665,112	322,462	5.3
Washington	2,641,300	1,584,750	6.0	844,936	509,621	.7	4,033,668	2,269,244	28.1	2,038,459	963,341	7.5
West Virginia	2,890,000	1,445,000	7.5	624,800	312,400	6.7	3,930,690	1,965,345	11.8	1,193,750	584,875	2.1
Wisconsin	159,000	159,000	.5				4,134,550	2,107,850	8.5	1,242,847	609,500	10.8
Wyoming	770,000	497,574	4.5	185,436	126,409	6.2	5,282,267	3,528,536	79.0	1,182,041	762,234	17.7
District of Columbia												
Total	222,381,987	113,614,754	853.6	94,852,526	48,085,454	317.8	398,120,670	199,361,762	1,619.9	192,986,659	98,211,572	1,232.0

[1] Initial commitment of funds.

Table 12.—*Federal funds paid by Bureau of Public Roads during the fiscal year ended June 30, 1952, by program and by State*

State or Territory	Federal-aid funds			Prewar Federal-aid unds			Defense highway funds	Emergency funds 1933–35	Total
	Primary [1]	Secondary	Urban	Primary	Secondary	Grade crossing			
Alabama	$3,021,956	$3,204,870	$508,047	$80		$166,402	$42,282		$6,943,637
Arizona	2,925,479	2,290,434	458,110	14,425	$2,301		49,820		5,740,569
Arkansas	3,890,795	2,364,659	120,012	24,825			49,144		6,449,435
California	8,672,035	4,864,846	5,779,453		28,305	93,131	67,178		19,504,948
Colorado	4,080,299	2,215,633	931,382	17,581	4,758	38,056			7,287,709
Connecticut	883,074	430,736	2,625,497						3,939,307
Delaware	1,017,412	595,756	33,605						1,646,773
Florida	3,734,135	2,278,461	1,896,685			41,700			7,950,981
Georgia	3,817,916	3,307,107	1,070,821	89,163	50,502	143,256		$312,693	8,791,458
Idaho	2,209,759	1,145,328	170,656	884			97,038		3,623,665
Illinois	10,260,810	1,748,728	7,959,578			130,715			20,099,831
Indiana	2,366,924	1,465,352	1,569,037				4,888		5,406,201
Iowa	4,332,056	3,941,679	1,858,509			28,760	54,374		10,215,378
Kansas	5,463,257	1,888,565	788,003	3,977			44,319		8,188,121
Kentucky	2,552,249	1,992,107	321,923	226,987	6,428	1,725	434,119		5,535,538
Louisiana	5,155,307	3,164,517	300,831	158,316	25,035	191,612	63,171		9,058,789
Maine	1,377,440	1,036,901	−54,046	10,581	1,990	28,665	565,422		2,966,953
Maryland	1,524,170	458,927	927,461				57,297		2,967,855
Massachusetts	1,727,733	601,284	6,004,912	106,515	8,150	111,941	30,089		8,590,624
Michigan	4,560,609	3,526,805	4,927,734	865	2,400	−3,265	133,099		13,148,247
Minnesota	4,914,142	3,125,301	1,752,703	223,185	87,224	91,188			10,193,743
Mississippi	3,150,910	3,299,849	896,188			3,390	29,893		7,380,230
Missouri	7,248,649	2,408,161	2,346,166	63,468			107,543		12,173,987
Montana	3,948,105	1,599,408	155,095	61,637	48,247	3,645	45,619		5,861,756
Nebraska	3,534,942	1,564,744	742,874	23,983	82,599				5,949,142
Nevada	1,827,311	1,351,572	344			20,354	74,722		3,274,303
New Hampshire	955,812	757,970	92,149	65,989	11,282	35,863			1,919,065
New Jersey	1,908,091	527,274	2,257,260	34,754	13,532	13,187	820		4,754,918
New Mexico	4,448,105	2,391,636	255,800			56,032	97,214		7,248,787
New York	7,883,636	2,777,539	11,792,352	91,496	12,513	209,541	249,163		23,016,240
North Carolina	5,340,446	3,177,748	890,820	277,670	15,236	257,373			9,959,293
North Dakota	2,896,426	2,867,427	81,557	31,647	13,443	10,056	9,705		5,910,261

Ohio	10,434,355	3,405,964	6,946,565	265,449	353,997	62,151			21,468,418
Oklahoma	3,761,146	2,939,125	1,215,448			384,556	52,077		8,352,352
Oregon	3,339,459	2,514,588	796,777				68,154		6,718,978
Pennsylvania	6,755,104	4,459,961	7,624,654	42,848		79,558	98,108		19,060,233
Rhode Island	935,038	789,347	1,926,293	44,957	5,995	19,263	545		3,721,438
South Carolina	2,007,766	1,218,906	610,271	57,254	16,120	23,654	1,623,311		5,557,282
South Dakota	3,432,214	2,832,076	25,470	20,652	148,336	118,795			6,577,543
Tennessee	3,127,848	2,869,244	683,325	116,850					6,797,267
Texas	21,171,819	7,020,065	7,936,590			47,730	479,489		36,655,693
Utah	1,912,325	1,130,232	86,792		9,014	28,269	608,588		3,775,220
Vermont	410,500	579,697	32,031	21,078	2,286				1,045,592
Virginia	4,284,474	2,905,789	255,402	215,963		78,912	229,905		7,970,445
Washington	3,104,619	2,421,884	2,507,896				385,203		8,419,602
West Virginia	1,378,883	1,527,035	567,427		97,686		25,109		3,596,140
Wisconsin	5,189,147	2,623,886	897,773			426,808	23,925		9,161,539
Wyoming	2,758,062	1,785,879	12,986			821			4,557,748
District of Columbia	660,133	523,019	77,118		8,908	7,134			1,276,312
Hawaii	855,570	616,918	771,028				6,361		2,249,877
Puerto Rico	558,317	578,314	468,613	6,768	6,390	592			1,618,994
Total	197,706,769	111,113,253	92,903,977	2,319,847	1,062,677	2,951,570	[2] 6,661,914	312,693	[2] 415,032,700

[1] Funds available for either urban or rural portions of the Federal-aid primary highway system.
[2] Total shown includes $754,220 of expenditures made during the year but not distributed by States.

Table 13.—*Balances of Federal-aid funds available to States for projects not yet programed as of June 30, 1952*

State or Territory	Primary [1]	Secondary	Urban	Total
Alabama	$478,121	$2,351,982	$3,200,701	$6,030,804
Arizona	46,369	217,439	557,998	821,806
Arkansas	118,997	2,335,677	717,610	3,172,284
California	----------	3,138,574	59,000	3,197,574
Colorado	2,707,538	1,177,941	757,442	4,642,921
Connecticut	1,388,688	1,808,602	3,228,100	6,425,390
Delaware	528,934	745,079	1,042,567	2,316,580
Florida	821,343	268,014	1,960,709	3,050,066
Georgia	1,458,232	356,682	1,815,063	3,629,977
Idaho	1,405,902	3,624,807	385,321	5,416,030
Illinois	212,979	9,514,051	1,066,723	10,793,753
Indiana	569,200	5,358,456	1,418,975	7,346,631
Iowa	660,384	334,236	937,015	1,931,635
Kansas	719,938	5,146,932	1,312,401	7,179,271
Kentucky	584,054	161,609	824,955	1,570,618
Louisiana	137,318	139,208	2,754,793	3,031,319
Maine	199,818	72,592	550,405	822,815
Maryland	33,041	1,162,974	3,760,107	4,956,122
Massachusetts	2,329,031	77,547	1,448,573	3,855,151
Michigan	797,894	1,475,787	684,111	2,957,792
Minnesota	108,609	1,571,139	2,069,659	3,749,407
Mississippi	494,192	3,075,551	492,871	4,062,614
Missouri	625,302	4,679,757	4,064,655	9,369,714
Montana	3,958,765	4,205,101	545,160	8,709,026
Nebraska	4,318,454	5,656,935	1,220,453	11,195,842
Nevada	1,776,769	647,562	95,237	2,519,568
New Hampshire	800,211	583,455	208,791	1,592,457
New Jersey	556,154	439,142	649,667	1,644,963
New Mexico	692,988	294,246	384,271	1,371,505
New York	733,696	3,192,967	20,195,267	24,121,930
North Carolina	2,401,702	1,173,737	827,249	4,402,688
North Dakota	603,657	532,902	414,560	1,551,119
Ohio	271,068	3,705,404	4,953,606	8,930,078
Oklahoma	233,749	1,443,946	981,379	2,659,074
Oregon	411,256	386,184	910,294	1,707,734
Pennsylvania	1,571,671	953,666	3,239,428	5,764,765
Rhode Island	166	681,658	89,193	771,017
South Carolina	2,481,359	421,492	612,919	3,515,770
South Dakota	301,273	296,771	606,563	1,204,607
Tennessee	1,068,199	395,462	2,281,593	3,745,254
Texas	303,681	8,810,317	3,069,843	12,183,841
Utah	685,548	129,994	528,104	1,343,646
Vermont	560,718	83,622	488,198	1,132,538
Virginia	966,935	368,446	3,661,150	4,996,531
Washington	958,723	762,370	594,000	2,315,093
West Virginia	1,648,831	994,944	275,988	2,919,763
Wisconsin	180,579	2,923,217	1,094,100	4,197,896
Wyoming	40,551	184,813	40,393	265,757
District of Columbia	153,475	177,504	286,962	617,941
Hawaii	543,613	959,224	39,026	1,541,863
Puerto Rico	2,026,191	2,077,951	1,041,309	5,145,451
Total	46,675,866	91,277,668	84,444,457	222,397,991

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

Table 14.—*Average number*[1] *of persons employed on Bureau of Public Roads and State highway construction and maintenance, United States and Territories, by program and by month, for the fiscal year ended June 30, 1952*

Year and month	Federal-aid programs	Prewar Federal-aid programs	Federal forests, parks, public lands, flood relief, and miscellaneous	Total Federal programs	State highways, with State funds only	Road maintenance by State highway departments	Total construction and maintenance
1951							
July	81,105	141	4,311	85,557	53,116	128,024	266,697
August	80,948	172	4,731	85,851	54,397	129,429	269,677
September	76,295	277	4,146	80,718	51,814	121,067	259,629
October	71,575	169	3,862	75,606	53,151	121,524	250,281
November	54,791	128	2,662	57,581	41,947	120,521	220,049
December	39,330	121	1,976	41,427	33,628	118,551	193,606
1952							
January	31,100	141	1,474	32,718	26,563	118,621	177,902
February	33,229	142	1,686	35,057	24,434	115,126	174,617
March	39,205	108	1,675	40,988	27,512	116,987	185,487
April	57,492	110	4,359	61,961	37,052	118,411	217,424
May	69,757	124	5,412	75,293	44,932	122,354	242,579
June	83,639	110	4,315	88,064	53,497	128,338	269,899

[1] Average number of persons employed is computed as the mean of the weekly payroll counts made during the calendar month.

Table 15.—*Mileage of designated Federal-aid systems, by State, as of June 30, 1952*

State or Territory	Federal-aid primary highway system			Federal-aid secondary highway system
	Total	Rural	Urban	
	Miles	*Miles*	*Miles*	*Miles*
Alabama	5,120	4,843	277	11,110
Arizona	2,522	2,442	80	2,956
Arkansas	3,481	3,346	135	13,011
California	7,223	6,440	783	9,403
Colorado	4,024	3,914	110	3,695
Connecticut	1,109	816	293	1,110
Delaware	527	488	39	1,275
Florida	4,321	3,910	411	10,403
Georgia	7,128	6,793	335	12,507
Idaho	3,475	3,434	41	3,407
Illinois	10,328	9,352	976	7,888
Indiana	4,826	4,261	565	9,046
Iowa	9,684	9,338	346	33,040
Kansas	8,204	7,986	218	21,225
Kentucky	3,883	3,671	212	10,960
Louisiana	2,657	2,429	228	5,608
Maine	1,648	1,563	85	2,261
Maryland	1,941	1,647	294	5,370
Massachusetts	2,058	1,052	1,006	2,176
Michigan	6,494	5,985	509	16,893
Minnesota	7,388	6,908	480	15,426
Mississippi	4,571	4,409	162	8,445
Missouri	8,206	7,975	231	14,009
Montana	5,872	5,805	67	3,251
Nebraska	5,567	5,430	137	10,412
Nevada	2,201	2,173	28	2,099
New Hampshire	1,192	1,065	127	1,297
New Jersey	1,744	1,212	532	1,919
New Mexico	4,167	4,025	142	4,283
New York	10,438	9,000	1,438	19,356
North Carolina	7,353	7,002	351	13,690
North Dakota	3,267	3,222	45	10,571
Ohio	7,659	6,610	1,049	12,384
Oklahoma	7,411	7,167	244	10,633
Oregon	3,915	3,739	176	4,554
Pennsylvania	7,873	6,675	1,198	10,734
Rhode Island	467	234	233	335
South Carolina	4,504	4,284	220	10,478
South Dakota	4,233	4,140	93	11,912
Tennessee	5,210	4,951	259	9,157
Texas	15,996	15,379	617	23,064
Utah	2,300	2,184	116	2,904
Vermont	1,238	1,180	58	1,786
Virginia	5,074	4,780	294	16,684
Washington	3,454	3,235	219	6,801
West Virginia	2,354	2,122	232	11,010
Wisconsin	6,101	5,635	466	14,004
Wyoming	3,443	3,399	44	1,834
District of Columbia	145		145	57
Hawaii	538	510	28	579
Puerto Rico	570	434	136	1,021
Total	235,104	218,594	16,510	438,033

Table 16.—*Mileage of the National forest highway system, by forest road class and by State, as of June 30, 1952*

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	2,466.0	678.0	305.5	1,482.5
Colorado	1,507.0	583.0	466.0	458.0
Idaho	1,122.0	683.0	82.5	356.5
Montana	1,190.5	699.9	168.3	322.3
Nevada	313.7	157.2	130.8	25.7
New Mexico	655.0	207.0	293.0	155.0
Oregon	1,381.8	716.8	376.9	288.1
South Dakota	302.0	189.0	101.0	12.0
Utah	690.0	187.0	216.0	287.0
Washington	755.8	387.7	104.6	263.5
Wyoming	535.0	396.0	109.0	30.0
Alaska	366.6	----------	----------	366.6
Total	12,344.6	5,290.7	2,737.6	4,316.3
Eastern region:				
Alabama	250.9	105.9	112.6	32.4
Arkansas	633.6	111.6	522.0	----------
Florida	207.0	33.0	152.1	21.9
Georgia	349.7	153.4	147.9	48.4
Illinois	306.8	245.8	30.5	30.5
Indiana	101.2	53.6	47.6	----------
Kentucky	352.9	131.1	180.3	41.5
Louisiana	402.3	54.1	94.4	253.8
Maine	14.0	----------	----------	14.0
Michigan	1,169.6	582.1	509.8	77.7
Minnesota	718.8	256.5	292.3	170.0
Mississippi	507.4	257.2	221.6	28.6
Missouri	985.7	379.7	471.3	134.7
Nebraska	29.8	----------	12.0	17.8
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	36.7	193.5
South Carolina	377.7	230.9	146.8	----------
Tennessee	348.3	165.1	148.9	34.3
Texas	307.2	129.2	170.5	7.5
Vermont	119.1	32.7	61.9	24.5
Virginia	1,351.8	399.9	773.6	178.3
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	11,068.8	4,125.4	5,230.1	1,713.3
Grand Total	23,413.4	9,416.1	7,967.7	6,029.6

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

Table 17.—*Status of National forest highway projects as of June 30, 1952, 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	$298,000	$149,000	21.6									
Arizona	1,290,000	1,290,000	23.3	$408,000	$408,000	5.9	$1,222,684	$1,222,684	27.9	$1,054,546	$1,054,546	22.4
Arkansas	302,124	302,124					520,891	520,891	30.2			
California	3,570,561	3,570,561	28.5	590,000	590,000	4.0	2,341,024	2,329,024	25.0	1,603,545	1,603,545	31.5
Colorado	2,125,000	2,125,000	42.4	600,000	600,000	20.2	712,000	712,000	8.8	1,120,128	1,120,128	29.9
Florida				539,386	269,500	15.4				315,047	145,606	18.7
Georgia	194,294	97,147	6.0				308,854	154,427	13.3	251,776	125,888	8.4
Idaho	3,139,000	3,139,000	64.7	1,647,000	1,647,000	37.2	3,628,000	3,628,000	37.6			
Illinois	139,000	69,500	3.7									
Indiana	100,000	42,413	.2							50,586	17,564	.1
Kentucky	87,256	87,256	1.5									
Louisiana										245,131	122,360	1.8
Michigan	851,204	577,204	29.1				195,300	128,650	8.4	268,309	219,333	19.2
Minnesota	462,703	462,703	10.6	145,000	145,000		192,000	192,000	11.2			
Mississippi							121,900	60,950	10.7			
Missouri	309,612	309,612	9.1	121,844	121,844	3.3	125,482	125,482	8.4			
Montana	2,545,000	2,545,000	62.7	311,000	311,000	6.2	1,382,000	1,382,000	40.1	1,621,500	1,621,500	54.9
Nebraska	36,336	36,336	2.0	63,100	63,100	2.8	95,930	95,930				
Nevada	300,000	300,000	3.0	31,000	31,000	.6	289,000	289,000	2.3	586,244	584,322	10.0
New Hampshire	41,610	41,610		391	391	.1	342,000	342,000	4.2			
New Mexico	1,250,000	1,250,000	17.8				724,300	724,300	17.2	248,200	248,200	7.7
North Carolina	512,486	256,243	12.5				627,610	313,805	12.8			
Ohio	37,000	37,000	1.9									
Oklahoma	170,000	85,000	3.7									
Oregon	3,780,000	3,780,000	68.7	705,000	465,000	15.1	3,578,000	2,977,000	38.3	885,000	804,945	32.4
Pennsylvania	50,000	50,000	1.2				111,000	111,000	5.8			
South Carolina							104,710	51,005	9.0	157,000	72,074	4.6
South Dakota	160,000	160,000	2.0				249,000	249,000	3.2	331,000	331,000	6.8
Tennessee	790,000	395,000	29.5							411,658	205,829	6.7
Texas	126,100	126,100	2.5							155,157	77,500	6.3
Utah	417,000	417,000	11.3	667,500	667,500	46.8	309,600	309,600	4.1	381,946	381,946	22.5
Vermont	37,293	37,293		2,648	2,648					40,052	40,052	.4

Virginia	400,000	200,000	7.4				11,288	5,644	1.9	217,829	126,003	14.5
Washington	1,866,500	1,758,800	43.1	536,500	536,500	15.9	1,730,000	1,567,000	32.1	755,976	755,976	28.6
West Virginia				201,100	100,000	6.2	304,656	165,998	4.9			
Wisconsin							197,059	197,059	12.1	147,889	139,889	10.3
Wyoming	610,000	610,000	16.3	770,000	770,000	16.8	932,830	932,830	27.9	190,000	190,000	4.9
Alaska	700,000	700,000	6.8	708,200	708,200	5.9	1,007,000	1,007,000	10.8	1,630,000	1,630,000	10.2
Total	26,698,079	25,006,902	533.1	8,047,669	7,436,683	202.4	21,364,118	19,794,279	408.2	12,668,519	11,618,206	352.8

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