

our problem to meet these demands where economically justified. Only by careful, long-term planning, and by using every available dollar can this be done. In my own county such a plan is being developed. Our future work will be so laid out that we believe future administrations will be glad to carry on. This plan will depend heavily upon WPA. The type of work done will be regulated by its costs. We intend to stretch our dollar to its utmost. By planning our budget we can carry part of the salvaging load, but we never will be able to carry all of it.

No attempt has been made to explain procedure. From investigation it is evident that each county has a method it uses. Its equipment is purchased to suit that method. That is not so essential to me as the ultimate end, which is a higher-type road. How we do it in St. Joseph County is not so important as what is accomplished. Therefore, our problem is a planned program employing the use of all federal and state aid available, with careful budgeting of the county dollar. If we do this, our roads will show increasing improvement, and the motoring public will receive the benefit of this effort.

PRESENT STATUS OF THE HIGHWAY PLANNING SURVEY

G. R. Harr,
Associate Highway Engineer,
U. S. Public Roads Administration,
Indianapolis

In 1934, Congress passed the Hayden-Cartwright Act, which included feeder roads and grade crossings in federal-aid appropriations. Since that date, the federal government has spent more on secondary roads than on primary roads, including FA, PWA, and WPA. In that act and all succeeding acts carrying appropriations for roads, Congress has set aside $1\frac{1}{2}$ per cent of federal funds for engineering and economic investigations. This made possible the planning surveys being conducted in 46 states, including Indiana.

In 1935, the Indiana General Assembly created a Highway Survey Commission to conduct a survey of the entire highway system of the state. This survey was started in November of that year.

The primary objective of these surveys is to provide the facts needed for an intelligent and economical attack on our ever-increasing road problem. These facts include the mileage of roads and their condition, such as width of surface, width of right-of-way, depth of surface, alignment, and grades; the service they render; the source, destination, and kind of traffic; and the cost of the roads. Studies were made of the

relation of road cost to traffic use. Studies are being made on the relation of highway costs to other costs of government services as a whole. This is a large assignment and requires a series of related, continuing, fact-finding surveys for planning an adequate, economical, and socially defensible, integrated highway system.

To arrive at these facts, the survey was divided originally into three phases—inventory, traffic, and financial.

In one sense, the entire survey is an inventory, because we are taking stock, determining what we have on hand and what we shall do with it. In Indiana there are 75,000 miles of roads, 10,000 miles of streets, and an area of 36,045 square miles; thus, we have 2.1 miles of road and 0.3 mile of street per square mile of area.

In the inventory it was necessary to secure all information obtainable about the existing highways that we have been building for more than a century—most of them in the last 50 years. We must determine their total length by sections, width of right-of-way, type of surface, width and thickness of surfacing material, grades, curvature, sight distance, structures (spans of 20 feet and over), grade separations, rural and municipal grade crossings, speeds of trains, accidents, highway traffic, sight distances, hazards, and ferries and toll bridges within the state or on state lines.

Along with this it was necessary to determine the cultural development along these roads, such as dwellings, businesses, factories, mines, quarries, airports, golf courses, lakes, recreation centers, parks, churches, and schools, all located at their relatively correct positions along the highway.

In co-ordination with this, all other transportation systems were located, such as steam and electric railroads, rivers, airways, truck and bus lines, mail routes, and school bus routes.

MAPS PREPARED

From this information maps have been made of each county of the state. Indiana lacked good foundation maps, and the planning survey has been handicapped because of this. There will be a series of five county maps all produced from base maps. The first four will cover highways and transportation, passenger busses and trucks, school busses, and mail routes. These maps as yet are not absolutely correct, but are the best the state has ever had. Had there been available coast-and geodetic-survey maps of the entire state or aerial photographs, our maps could have been made more accurate. Other states have had an advantage over Indiana by having such maps available. As the aerial-photograph maps, and coast-and geodetic-survey maps are extended in Indiana, the planning survey expects to revise its maps and eventually get them correct.

Detailed railroad-crossing surveys in the rural areas have been completed, but the municipal-crossing survey is still

under way. The railroads have co-operated by furnishing the survey with complete sets of railroad right-of-way maps. They also assisted by making complete crossing-service and five-year accident reports on forms furnished by the survey. From this date it is planned to find hazard factors for all railroad crossings, from which their priority of treatment will be set up.

TRAFFIC STUDIES

Repeated eight-hour traffic counts throughout the year at 162 fixed key stations, scattered all over the state, provided data from which a 24-hour average annual and daily traffic was computed for the main and typical routes. At control stations, at numerous other points throughout the counties, eight-hour counts were taken once each season, which were used in conjunction with some 15,000 single eight-hour counts blanketed over the entire state. From the factors developed from the key and control stations, it is possible when applied to the single eight-hour counts to get average annual 24-hour traffic on every mile of highway in the state.

In 1936, six automatic traffic recorders were installed, one in each of the state highway districts, on an important road adjacent to one of the key stations. Throughout the year continuous traffic counts are recorded by these devices. Thus, the survey was enabled to get check factors at these stations. These recorders are still operating. Twelve additional automatic recorders have been installed since October, 1939, on other state routes, six of which are on secondary roads. From these 18 counters it is hoped, with the use of additional portable counters, to be able to keep the traffic data up to date.

A state map as well as 92 county maps (the last of the group of five I mentioned before) are being prepared to show this traffic in graphic form by traffic bands.

While traffic counts were being made, origin and destination data were collected from trucks at 92 of the key stations and at many of the control and single eight-hour stations. At the key stations, trucks were weighed and contents noted, and tables are being prepared giving all of these data.

Four pit-scale stations were created where commercial weighing scales were built along the highway, two on U. S. 31, one on U. S. 40, and one on U. S. 41. Here trucks were weighed and measured, and their make, year and model, and their origin, destination, and loading practice were recorded. The size and type of tire equipment were noted. Tables are being prepared from these data.

A special study was made at South Bend, Mishawaka, and Elkhart, and around these cities, to determine, by origin, destination, and preference, the desirability of a by-pass. A special study was made here at Lafayette in conjunction with Purdue senior civil engineers on traffic distribution resulting from opening of the by-pass.

All this information was collected in order to determine the service or lack of service being rendered the motorists by the various highway systems, state, county, and city streets.

FINANCIAL STUDIES

The financial phase consisted of four studies covering fiscal, road use, motor vehicle allocation, and road life.

The fiscal study analyzes the receipts, expenditures, and debts for all purposes of the state government and its political subdivisions. It shows the relation of highway revenues and expenditures to those for other purposes, such as education, public welfare, and general government.

The road-use study arrives at estimates of total yearly travel and gasoline-tax payments, and the extent to which each vehicle owner uses the different systems of roads.

The motor-vehicle-allocation study shows the urban and rural distribution of the tax-paying vehicle owners.

The road-life study is an application of the actuarial methods used by life insurance companies by which the probable life of pavements may be determined. To do this, every mile of pavement or road surface on the state highway system has been carded as to its date of building, its cost, type, character, replacement, and retirement, from its known beginning to date. The maintenance costs likewise have been carded.

Construction tables are now being prepared, and the same will be done with maintenance tables. From these tables the pavement life of each type will be studied and a better understanding gained of what we can expect as to their future.

USE OF DATA

Land-use planning will be aided by this information, available to those interested in that one great problem in this country. From proper land-use planning, those highways serving land that has lost its usefulness will cease to be developed. Highways will not be further developed to serve submarginal lands, and highways through forest areas, wild life preserves, and park areas will not be overdeveloped.

When a proposal was placed before Congress to build six transcontinental roads across the U. S., it was favorably considered by many; but when the proposal was referred to the committee on roads and to the President, the Public Roads Administration was asked for a report on the proposal. From the planning surveys, the Public Roads Administration was able to get data and facts to submit to the President their remarkable 132-page report on "Toll Roads and Free Roads."

In this report it is shown that these six super-highways would cost about \$3,000,000,000, and the operating cost

would be 60% greater than the possible toll revenue over a period of 15 years, from 1945 to 1960, with a large general traffic increase on all other roads, but with a limited use of toll roads.

The report also shows that, of the traffic entering or leaving large cities, about 5% to 6% is entirely through traffic, another 6% to 7% is from the city to points far beyond, leaving about 87% of local destination or origin.

The Bureau of the Census and the Brookings Institute have used much of the survey data. Railroads, trucking companies, large oil companies, etc., are awaiting the availability of the traffic maps and the loadometer and pit-scale tables.

From the inventory and traffic survey data, the highway commission can determine what roads should become a part of the state system. From the financial studies it can know what funds it may receive and where and how they should be spent. The counties will likewise be able to follow the same procedure. The Public Roads Administration now requires that the survey data be used in determining what shall be the Federal-Aid feeder-road system and where Federal Aid shall be applied to the Federal-Aid system. Further uses will be found for this information as we are able to analyze the data and the tables.

These data and the tables, some two or three thousand, will be in the planning survey files, from which information can be obtained as we complete the analysis.

The base maps, which show the road-traffic bands and all basic data, are complete for the 92 counties. All county general highway and transportation maps will be complete by March 1, and the traffic flow maps about August 1.

The road-use survey is complete, with the report prepared and approved. The motor-vehicle-allocation survey is complete and the report prepared. All other phases should be completed by the end of this year.

The last appropriation act passed by Congress requires that 1½% of the Federal-Aid funds for highways and grade crossings be used for planning surveys, which means the continuation of this work. It means the keeping up to date in road construction, traffic, and financial studies, so that as changes take place the highway commission and Public Roads Administration will know of them and be able intelligently to administer this big business of highways for highway users.

The highway commission and the Public Roads Administration are continually requesting information from the planning survey, and it is furnished to them rather quickly. Much of the factual data they would have been unable to get without the survey. The President and Congress would have had nothing upon which to base their action on toll roads had these data not been available.

The survey data are to be used in determining the relative need for the widening of surfaces on highways beyond two

traffic lanes and for the frequencies of different weights and dimensions of large vehicles on highways for the general design policies for both roads and bridges, and for legal restrictions as to weights and dimensions of vehicles. It will be used also to establish a measure of the commercial-traffic characteristics, to be used to determine the degree of adequacy of existing improvements.

Some of the other states that have been able to complete their original survey have outlined and planned their highway program for the next twenty years. Indiana hopes to be able to do something similar in the near future.

PRESENT AND FUTURE STATUS OF THE FARM-TO-MARKET ROAD PROGRAM

Earl B. Lockridge,
Assistant Chief Engineer and Engineer of Construction,
State Highway Commission of Indiana,
Indianapolis

At the 1938 Purdue Road School I talked on the subject "The Farm-to-Market Federal Road Program." Today I shall attempt to explain the "Present and Future Status of the Farm-to-Market Road Program" as it applies to the State of Indiana.

HAYDEN-CARTWRIGHT ACT

On the former occasion I set out at considerable length the preliminary proceedings and details involved, in order that a true picture might be had of the mechanics required in establishing a Federal Aid Secondary Road project. That discussion referred to the action of Congress resulting in what is commonly known as the "Hayden-Cartwright Act" approved June 16, 1936, which act authorized to be appropriated to the several states to be apportioned and expended under the provisions of the Federal Highway Act of 1921, as amended and supplemented: "The sum of \$25,000,000.00 for fiscal year ending June 30, 1938, and like amount for fiscal year ending June 30, 1939: Provided, That the sums authorized be applied to Secondary or Feeder Roads, including farm-to-market roads, rural free delivery mail roads, and public school bus routes."

MEANS OF ADMINISTERING ACT

The Federal Highway Act required the Secretary of Agriculture to prescribe and promulgate all needful rules and regulations for the carrying out of its provisions. In compliance with this responsibility, the Secretary of Agriculture caused to be prepared and approved on February 9, 1937, certain basic rules and regulations for carrying out the provisions of the secondary- or feeder-road legislation.