

analyses which we have been able to make will show the trend of the final results. More than one-half million cars were stopped in obtaining this data.

One of the factors for which we are unable to determine the proper weight at the present time is that this is a depression period. Traffic was, we believe, subnormal in July; it was less than in June, the decrease affecting both passenger and commercial traffic. Traffic, however, increased to what we would expect to be a normal rate in August. It may be of interest to you to know that these observed fluctuations in traffic have been accompanied by a corresponding fluctuation in the payment of gasoline taxes. This, we believe, adds weight to our belief in the veracity of our figures.

In conclusion, I wish to emphasize the fact that methods of studying traffic have been developed which are fundamentally and basically sound. These methods have been simplified so that the cost of making a study of this kind is very reasonable. The information which we develop in our studies can be taken by you as being accurate. I would like to urge that you study your local traffic along similar lines, and that thus you individually and severally add to the completeness of the picture, the general outlines of which will be determined by the state highway department's studies.

I urge that you plan a similar study of traffic in your own counties and from it develop the proper picture of your traffic situation, its needs and requirements, and from this picture plan and conduct your future improvement program. If this is done, I then believe you will be able to have confidence that the funds of the people which are intrusted to you will be properly and economically expended.

PRELIMINARY RESULTS OF HIGHWAY TRANSPORT SURVEY IN INDIANA

By F. A. Henning, Engineer, Special Assignment, Indiana
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Before entering into the discussion of the preliminary results as produced by our survey, I should like to impress upon you the necessity of having a fixed and definite objective in mind before collecting traffic data. The data procured must be in line with the results you are seeking. Much unnecessary expense can be incurred by collecting and later analyzing data which is of no value in the final analysis of the survey. Methods employed should produce a maximum of information of the kind required. The one outstanding item of all transportation survey work in our opinion is traffic density.

In order to set up a field organization to procure a traffic density count on the state highway system, it was decided to make use of the maintenance forces because their services were continuously available and their training could be utilized throughout the entire period of the count. A meeting of superintendents was arranged by each district engineer of maintenance in his district. These men, being thoroughly familiar with their subdistricts, were of great assistance in the selection of station locations. Junctions or intersections of state highways and the intersections of important county roads with state highways were selected. These locations were supposed to cover all points at which material changes in both volume and direction of flow occurred.

Subsequently, meetings were arranged in each subdistrict by the superintendent. Men best fitted to properly record traffic on tally books were requested to attend and a representative from our office assisted in instructing them in their duties. To the average layman, the tally sheet used was very simple and it has proved successful. Traffic was recorded as to direction and type of vehicle, whether passenger car or truck. Busses were classified as trucks. If the vehicle carried a foreign license plate, it was also recorded as a foreign truck or passenger car. One seasonal count was made in which busses were separated from trucks. This confirmed our impression that bus traffic constituted such a small percentage of the entire flow that it was not necessary to keep it separated.

FLOW MAPS

Numerous office forms had to be prepared to handle the mass of data obtained in the field. On these forms, the information was summarized so as to be available at any future time for various studies and analyses, including the preparation of flow maps. In addition to being of general interest, flow maps should be of inestimable value to the engineer in aiding him in deciding details of construction and in assisting him in the arranging of building programs and determining priority of construction.

The maps show readily a number of things of general interest. Indianapolis Avenue in Lake County, which combines U. S. Routes 12, 20, and 41, carries the heaviest flow of any road in the state. On Sunday, August 28, approximately 29,000 vehicles used this route. The second heaviest route is U. S. 12, leading into Michigan. Our survey shows that this particular section of road carried 11,341 vehicles in 24 hours on the same Sunday. Truck flow was almost negligible on Sunday, August 28, as compared to a May or August week-day. Extremely heavy traffic uses the two parallel routes between Elkhart and South Bend, the Dunes Highway and the Dunes

Relief Highway between Michigan City and Gary, and U. S. 31 and 35, the two routes between Indianapolis and Franklin.

According to Mr. E. W. James, Chief of the Division of Highway Transport, United States Bureau of Public Roads, more important highways center at Indianapolis than at any other city in the United States. Through routes such as 30, 34, 40, 52, 31, 41, and 9 (from Anderson to Fort Wayne) maintain a rather uniform flow throughout their entire length. On the other hand, Route 67, maintaining a heavy flow from Indianapolis to Muncie, carries very few vehicles beyond that point. The same is true of Route 37 between Indianapolis and French Lick, and several others have this same characteristic.

Construction operations made it impossible to show flow on several sections of roads. Because of this element, several sections are abnormal, while others are subnormal.

CLASSIFICATION SURVEY

No doubt nearly every resident of Indiana has at some time during the past few months been confronted by a sign located in the center of the road bearing the inscription, "Stop—Traffic Survey Station." Here you were asked, "Where are you from and where are you going?" This perhaps was followed by another question, "Do you live there or on a farm near there?" By these questions, we were able to classify each vehicle as to the residence of ownership and the origin and destination of the trip being made. A record was made as to direction of travel, type of vehicle, and whether state traffic or foreign. The public at large became quite familiar with what was wanted, and a great many cars just slowed down to a very slow rate of speed so that on the fly, so to speak, the recorder was given the information he desired. This method of stopping vehicles was discontinued in November. Weather conditions became such that the practice became hazardous. Also, public resentment arose at lowering windows to impart information. Before discontinuing the stopping of traffic, a plan was developed where, by taking license numbers, we can obtain sufficient information until such time as weather conditions will permit us to return to our original method, and we are following this plan now.

PRELIMINARY RESULTS

Since fragmentary results are often misleading, please bear in mind that these figures are in no way final, but we do feel that they are reasonably in line with what the final analysis will show.

There are approximately 8,423 miles of roads in our state highway system and 68,822 miles of county roads, making a total of 77,245 miles. Thus, the percentage of state roads is

approximately 10.9. Our figures show that 65 per cent of all rural traffic is on state roads and 35 per cent is on county roads.

COMMERCIAL TRAFFIC

Our survey shows that commercial vehicles comprise 15.5 per cent of all travel on state roads. On county roads, we find that commercial traffic represents 22 per cent of all travel. This seemed rather high to us at first, but we would not be surprised to find this percentage even higher in our final analysis. We found 13.1 per cent of all traffic on state roads to be foreign; 7.9 per cent of traffic on county roads was foreign. On all roads, 11.3 per cent was foreign. Bus traffic was included in these percentages, but it constituted only 8/10 of 1 per cent of all traffic and about 5 per cent of commercial or truck traffic on state highways. School busses were classified as trucks. Bus traffic on county roads was almost negligible. On first thought, one might doubt this, but since there are less than 1,000 busses registered in the state, compared to a total registration of some 800,000 vehicles, one can readily understand why this percentage is small.

RESIDENCE OF OWNERSHIP

On state highways, 69.2 per cent of all vehicles were city owned. Farm-owned vehicles constituted 14.8 per cent and town- or village-owned 16.0 per cent of the total. On county roads, 61.5 per cent were city-owned, 23.3 per cent farm-owned and 15.2 per cent town- or village-owned. On all roads, these percentages were 66.8, 17.7, and 15.5, respectively. Figures compiled by us from registration addresses show that of all vehicles registered 54.3 per cent are city-owned, 26.6 per cent farm-owned, and 19.1 per cent town- or village-owned. These figures show that while only 54.3 per cent of all vehicles are registered in the cities, these same city-owned vehicles constitute 66.8 per cent of the traffic. Our observations also show that on state highways 54.1 per cent of the traffic was from city to city, 19.1 per cent from city to country, 16.8 per cent from country to city, and 10.0 per cent from country to country. On county roads these percentages were 38.7, 21.9, 18.2, and 21.2, respectively. On all roads these percentages were 49.2, 20.0, 17.1, and 13.7, respectively. This confirms the previous statement that over 2/3 of all highway traffic originates in the cities.

USE TO BE MADE OF DATA

Problems of financing construction and maintenance on all roads can be solved to the best advantage when all information concerning the use of the roads has been procured. Present volume of traffic as shown by the counts now being

made, when considered in connection with registration figures, gasoline consumption, and population growth covering a long period of years, will indicate with reasonable accuracy future traffic density for the state as a whole as far ahead as five or ten years. Individual sections of certain roads will be affected by the construction of new highways, diversion routes near the large cities, the development of large industrial projects or resort areas, etc.; and such factors will have to be taken into consideration in the design of improvements in such locations. It is obvious, however, that reasonably accurate estimates of future traffic should be utilized in planning all future development of our transportation system.

IMPROVED METHODS OF BITUMINOUS SURFACE TREATMENTS

By C. W. McClain, District Engineer,
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Surface treatments have come to mean far more than they once did. The early method was merely the spreading of a film consisting of a coat of some bituminous material, followed sometimes, but not always, with covering metal. This covering applied to the early treatments usually consisted of sand, with little attention being paid to its grading. The whole idea was to mop up the excess bituminous material. When that was done, the work was considered finished. It was observed, however, that a succession of such treatments built up a mushy mixture of considerable thickness, which under traffic developed into wrinkles and corrugations. This, together with the slippery nature of the driving surface, raised serious objections to roads and streets of this type. Regardless of any corrugations which developed, the riding qualities of such surfaces were not much improved by these treatments. With the great increase in quantity and speed of traffic during recent years, these objections had to be overcome.

Solutions of these problems were so obviously simple it is strange they did not appear sooner. It finally occurred to those in charge of this kind of work that coarser covering material and dragging of the treated surface, two simple remedies, would eliminate in large part these objections. However, in order to permit dragging, suitable bituminous materials had to be developed. Such progress has been made along this line that no difficulty is experienced in buying what is needed from any reliable tar or asphalt producing company. This is a tribute to the honest sales ethics now almost universally practiced by these companies. This is a wonderful help