perhaps many of you will not see at a glance the value of the data showing traffic characteristics such as location of ownership, origin of movement, destination, percentage of truck traffic regardless of weight, county, township, state and foreign traffic, and other elements shown in the report. All these items and many others have direct bearing on the problem of revenue for use on the different road systems or groups and without such information the proper solution of that problem would be impossible.

Copies of the complete report are available upon written request addressed to the State Highway Commission at Indianapolis.

USE OF TRAFFIC SURVEY DATA IN DEVELOPING THE STATE HIGHWAY SYSTEM

By John W. Wheeler, Member, Indiana State Highway Commission, Indianapolis, Indiana

Some years ago a former Highway Commission realized that Indiana had many miles of improved road—to be exact, 2.14 miles for each square mile of territory; a figure exceeded only by England as a nation and by two states, Massachusetts and Connecticut. We had 8,423 miles of state highways and 68,822 miles of county highways, but did not know who was using them. The need existed for a traffic survey to ascertain:

1. The number of cars actually using the state highway system.
2. The number of cars actually using the county highway system.
3. The number of trucks actually using the state highway system.
4. The number of trucks actually using the county highway system.

Glib-tongued secretaries of chambers of commerce would bring delegations before the Highway Commission and state that the road they were promoting carried 10,000 vehicles per day. They could not prove that it did and the Highway Commission could not prove that it did not. It was hard to tell which road should be paved first and which road should be resurfaced instead of being paved. In fact we had a road system, but did not know what load it was carrying.

The traffic survey gave the Highway Commission what a fever thermometer gives the doctor—an accurate reading of the existing conditions.

It might be supposed that a Highway Commission should know by intuition which roads carry the traffic, but let us see how this works. We often speak of U. S. 41 in Indiana as being a heavily traveled road, but let us look at the record of 41 and read the average daily traffic as found by the traffic survey.

Between Evansville and the junction of 62, which goes to Boonville, the average daily traffic is 3,132, but farther north
between Vincennes and Hazleton it drops to 1,499. Between North Terre Haute and Terre Haute it is up to 3,661, but twenty-five miles north of this point, or between Rockville and the south junction of 34, it drops to 774. From Boswell to the junction of 52 it is down to 580, but from Hammond to Whiting it is 7,642. From this we see that there are certain sections of 41 which should be widened immediately and certain sections for which the present twenty-foot width will suffice for years to come.

This traffic count is about 12 per cent under that of present-day traffic, if comparative gasoline tax revenues tell the true story; and wherever figures are read in this paper from the traffic count, it should be remembered that if the count were taken today, the results would be about 12 per cent greater than the figures in this report.

This traffic survey can be brought up to date very quickly by merely establishing the original key stations and operating them for a few days. The increase or decrease of traffic passing these key stations could be noted and the traffic for the balance of the stations could be interpolated from this data. Experience has taught us that these interpolations are reliable for all practical purposes.

Two factors must always govern the development of the highway system: the protection of life and limb, and economics. If a death-trap exists, it should be eliminated regardless of cost. By relocation it may be eliminated cheaply, but if it cannot be relocated and it is certain to cause more deaths, it should be eliminated at once. After life and limb have been reckoned with, economics should govern entirely. By economics I do not mean that the cheapest should always be built. Sometimes the most expensive may prove to be the cheapest over a period of years. Let me digress for a moment and repeat Colonel Chevalier's opening statement before the Association of Highway Officials of the North Atlantic States:

"The man who invented the motor car did something infinitely more far-reaching than simply give us a new vehicle. He laid the foundation of an entirely new transportation machine of which the motor-car is but one element. Soon after the advent of this first element came the second. That was a track upon which the motor car could operate, the modern hard-surfaced highway."

We are dealing in transportation because we represent the second element in the new transportation system, and let it be borne in mind as I read this paper that I consider the Highway Commission not merely a road-building body, but a state institution of transportation.

The cost of motor transportation equals the cost of the road plus its maintenance plus the cost of the operation of the vehicles over it. From this we can readily realize that the better the road surface, the less the cost of operation of the vehicle; or, stating it in the opposite form, the less spent
for construction and maintenance on the road, the more it will cost to operate the vehicle. On our 8,000 miles of state highways the cost of construction and the cost of maintenance must be put where the greatest number of vehicles use it. This has not always been done. Until two years ago, when the traffic survey was taken, no one knew where the greatest number of cars traveled. Mistakes were made. I do not say this critically of anyone, as we will all make mistakes, but my point is that in years past some concrete roads were built where stone roads would have been more economical, and some roads were resurfaced where new concrete construction would have proved cheaper in the long run. With the data made available by this traffic survey, such mistakes should not occur again.

There will be, however, examples of cases where this does not apply. For example, let us take U. S. 50, which starts in Washington, D. C., and extends to San Francisco, marked as U. S. 50 all the way, and connecting all principal cities on that general line. It enters Indiana at Aurora near Cincinnati, and goes through North Vernon, Seymour, Bedford, Shoals, Washington, and Vincennes. We found gaps on U. S. 50 in Indiana unimproved, although 150 out of the 170 miles in Indiana were paved with modern pavement. We had a problem confronting us. For instance, from Shoals east to the intersection with 37 south of Bedford the traffic count showed a daily average of only 411 on fairly new concrete pavement, but U. S. 50 was not a continuous paved road across Indiana, and traffic was avoiding it. We felt that because it was in general a highly improved road from Washington, D. C., to San Francisco, and because Indiana had in years past paved 150 out of the 170 miles with high-type pavement, we should close the gap with similar high-type pavement. This we did and we are finishing the final gap next spring.

There are definite well-known figures of the amount of traffic per day which low-cost roads will take without breaking up. For example, into the state highway system is taken a stone road which carries 400 vehicles per day. We give it a surface treatment or a mat; conditions change and this traffic increases, and our surface treatment or mat breaks up in less time than we figured it should. A new traffic count shows that this road is taking 900 vehicles per day instead of 400. It becomes apparent that new high-type construction is economical. The traffic survey showed that 66 per cent of all the traffic was on the state highway system, which comprises only 11 per cent of Indiana's roads. We feel that if 66 per cent of all traffic is on the state highway system, the major portion of the gasoline tax should be spent on the state system. The traffic survey showed that the average daily traffic over the state system (8,423 miles) was 818 vehicles; while
the average daily traffic over the county roads (68,822 miles) was 50.6 vehicles.

COUNTY ROADS DO NOT EARN MAINTENANCE COSTS

Between May 1, 1932, and April 30, 1933, the net revenue from the 4-cent gasoline tax earned on all rural roads was $10,656,867. Of this total, 66.5 per cent, or $7,081,766, was earned on state roads, and 33.5 per cent, or $3,575,101, on county roads. These figures are based on an estimated gasoline consumption by passenger cars of 15 miles per gallon and 11 1/4 miles per gallon by trucks, which are the figures used by the U. S. Bureau of Public Roads in its report on the survey of eleven western states. No evidence has been produced since the publication of that report to justify a revision of these figures, although all available pertinent data has been studied.

The net total earnings from the two sources just mentioned were $14,478,173. From these figures we find that in gasoline tax and automobile license fees the average state road earns $1.40 annually for each daily vehicle-mile of travel (365 vehicle-miles in a year) and that the average county road earns $1.39. On this basis it is evident that a considerable mileage of state roads is not earning the maintenance charges, which averaged $411.00 per mile in 1932. However, the average earnings per mile on the state system are $1,145.20. The average earnings on the county system are $70.33 per mile, which indicates that the county system as a whole does not earn its cost of maintenance, which in 1931 was approximated $187.00 per mile.

The survey now shows that the state highway system has perhaps some roads which should be in the county system, and that the county system has some roads that perhaps should be abandoned. From the traffic survey it is apparent that if the county roads are earning only an average of $70.33 a mile, and costing $187.00 per mile for maintenance, it is possible that land owes a certain contribution in the way of a road tax on the so-called farm-to-market roads. That road which only the farmer and his services use merely makes the farm accessible to town, and under the present set-up in Indiana the farmer contributes nothing to that road except his share of the gasoline tax and license fees. There may be miles and miles of such roads on which only a few residents live which must be maintained at an average expense of $187.00 per year. I believe that that land owes something toward the maintenance of its service roads.

Let us discuss for a moment another phase of this subject and substitute for the words "state highway system" the words "county highway improvements". If a traffic survey has been of great value to the State Highway Commission in planning its future road program, why would it not be equally as valu-
able to the individual county? Perhaps no county at this
time wishes to spend the money required to make a complete
traffic survey, and I do not know that I would recommend
that each county make such a survey. But in the future
when roads are proposed to be built, why could the county
not well afford to put out ahead of the surveying party, a
traffic survey on that road? It would cost very little to com-
plete a thorough traffic count on the road in question, and
before any money was spent, even in surveying that route,
the county commissioners and the county engineer could de-
cide whether or not that road in any way would earn enough
to pay for its construction and maintenance. It would show
the county commissioners and the county engineer at least
whether a high-type road or a cheaper road should be built.
The counties have made the same mistakes the state has made,
and have built some high-type roads where gravel or stone
would have been sufficient, and have resurfaced certain roads
where high-type pavement construction would have been
more economical. Causing the county surveyor to conduct a
traffic survey before he conducts his construction survey might
prove a means of saving much money in county road expendi-
tures.

While the statute prevents the State Highway Commission
from expending money off the state highway system, I am
positive that we could not be criticized in lending men from
our personnel, who could instruct in a short time your county
surveyor as to the proper method of making a traffic count,
either on the county as a whole, or on the road in question.
I am positive that the highway commission would grant this
favor to any county asking it.

The Indiana Highway Commission on all of its future work
is using, and will continue to use, the data compiled in this
traffic survey to guide in the economic expenditure of our
money. I am confident that traffic surveys could do the same
for counties when county road building again resumes.

At this particular time the legislature is in session. High-
ways and revenues for them will doubtless be discussed. The
motor vehicle owners, through the legislature, must say what
they want in Indiana concerning roads. Do they want a
larger and better state highway system? If so, more revenue
must be set up. Is the present allocation of the revenue from
the gasoline tax and motor vehicle tax satisfactory? If not,
how should it be divided? Who should bear the brunt of
future road construction—the State Highway Commission, or
the various counties? It is all our general problem, and re-
gardless of how we feel personally, the best solution is the
one we want.