

Annual Travel on County Highways of Indiana

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INTRODUCTION

One of the important items of highway information has been, and probably will always be, who should pay how much of the cost of building and maintaining roads and streets. Of similar importance is the question where should we spend the money collected in taxes for highways. Each year the highway officials at every government level have more roads which need to be rebuilt or maintained than available funds will permit. At every meeting of the state legislature, the needs of the state, the counties and cities for more road funds is eloquently and clearly stated.

In the absence of substantial increases in such funds comes attempts to change the distribution formula by which current funds are divided among the state, the counties and the cities. In recent years such attempts have been a biennial recurrence. The state with over 11,000 miles of highway, including most of the high volume roads and streets in the state, can ably establish the need for more money to reconstruct its many inadequate roads and bridges. The case for cities, with about the same mileage of streets and ever increasing populations and traffic growth, is well known to the average motorist and the need for more funds is easily established. The counties, with 68,000 miles of road—six times as much as the state or the cities in Indiana, have thousands of miles of low quality roads and hundreds of narrow bridges and too can present well the need for more funds.

One measure often used to determine the distribution of highway funds is that of vehicle miles. In 1965, the total vehicle miles traveled on all Indiana roads and streets was estimated to be about 25 billion. Of course, vehicle mileage is expected to increase—perhaps in a simi-

lar trend to that existing since 1950 as shown on Fig. 1. If so by 1985 over 41 billion vehicle miles of travel will annually move on Indiana roads and streets.

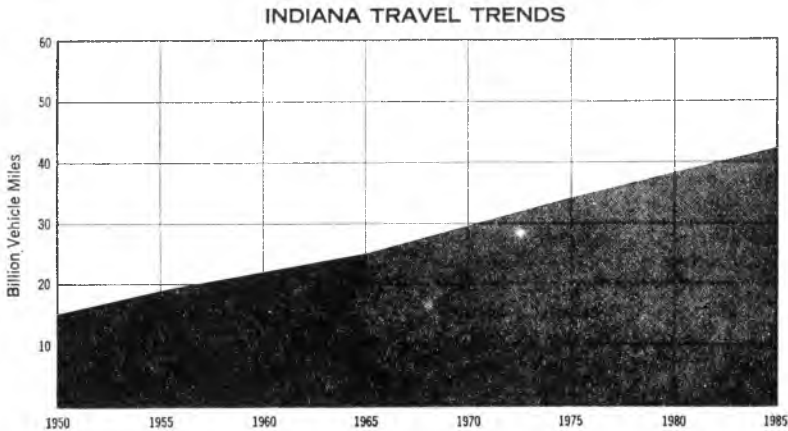


Fig. 1. Indiana Travel Trends.

Most persons would agree that a road carrying a high volume of traffic should be a better road than one carrying a low volume. And, of course the better road costs more money. As a result the inclusion within distribution formulas of vehicle miles as a measure of the importance of roads has been common. Although the state highway system comprises only slightly more than 12% of the total road mileage in Indiana it is estimated that it carries over 50% of the total vehicle miles. Furthermore, the state maintains current traffic volume information on all of its roads and can easily calculate the number of vehicle miles travelled each year on state highways. Some cities, especially the larger ones and those with an adequate traffic engineering department, also have considerable traffic volume and vehicle mile data. The counties, however, have little traffic volume data and a poor base on which to calculate vehicle miles of travel on county roads.

The absence of this information on county roads and the belief by many county highway officials that the vehicle miles of travel usually credited to county roads was less than reality, resulted in a suggestion by the County Commissioners Association to HERPIC* that it determine the annual vehicle mileage travelled on county highways in Indiana. The staff of HERPIC developed a proposal for such a study and upon approval of the plan initiated such research in late 1965. Data

* The Highway Extension and Research Project for Indiana Counties.

were collected in the summer of 1966 and the final report was presented in December 1966.

STUDY METHOD

The daily vehicle miles of travel on a particular road is the product of the length of the road in miles and the annual average daily traffic (AADT) on the road. This may be placed on an annual basis by multiplying by 365 days. When such an operation is carried out for all segments of all roads in the system, the sum of all products is the annual vehicle miles of travel on the system.

The desired estimate, i.e., the vehicle miles of travel, is the product of two variables; namely the roadway or section length which is known or can be measured, and the AADT which must be estimated. An estimate of AADT for each road section in an area is often based on a short count of traffic, such as for eight hours duration at a site on each road section in the area and a 24-hour count taken at one site on a road within the area. Each short count is then expanded to an estimate of AADT by appropriate expansion factors which are easily calculated from the 24-hour count data.

The approach used in this study was to obtain an estimate of the average AADT for all miles of road in the county highway system. This average when multiplied by the total length of the system, provided the estimate of the vehicle miles of travel.

Since the section length of road for which the AADT applies is a continuous variable, it was decided to measure all lengths to the nearest tenth of a mile. Each mile was considered as one sample. Thus, if a 2.5 mile road section had an AADT of 500, it was considered as 2.5 samples, each with an AADT of 500.

Since information on vehicle classification was desired and since many counts had to be made on aggregate-surfaced roads, the use of automatic traffic counters was precluded. All short counts, consequently, were taken manually. In all counties in which such counts were made, either personnel of the county highway department or persons especially recruited for the study by the individual counties were used.

If a sample of roadway sections is selected and the AADT on each section is measured, an estimate of vehicle miles of travel can be obtained. The validity of such an estimate depends on the validity of the assumption that the average AADT of those sections included in the sample is a good approximation of the average AADT for the entire system. The validity of this assumption, in fact, is dependent upon the variability of the AADT's and on the sample size. For example, if all road sections carried the same volume, there would be no variabil-

ity and one traffic count would be adequate. Obviously there is considerable variation in the AADT's of roads.

On the other hand, if the AADT of all roads were measured, variability would be no problem since then the true average AADT could be calculated and no estimate necessary. Obviously, this procedure would be prohibitively expensive. Thus, a sampling of road sections had to be used. The size of the sample required in order to measure the average AADT with a prescribed precision, such as plus or minus 5%, is a function of the magnitude of the variation.

Fortunately, traffic volume data for the primary and secondary county road systems of Allen County, Indiana, collected in 1955, were available for study [1].† These data showed that a better job of estimating vehicle miles of travel could be done if the road sections were classified into several volume strata rather than considered as one large stratum.

The data available from Allen County were in the form of section lengths and AADT's for 57 sections (146.6 miles total length) covering the primary county road system and for 54 sections (138.4 miles total length) covering the secondary county road system. No data were available for the remaining miles of county roads.

For the purpose of this study, a road section was defined as a length of road having similar volume characteristics throughout its length. Thus one traffic count was representative of the traffic volume throughout its length.

The problem was one of establishing the number of miles of road for which the AADT must be measured in order to obtain an acceptable measure of the average AADT for the entire system. When considering the entire 285 miles of Allen County's arterial road system, it was found that in order to estimate the AADT within plus or minus 5%, the required sample size was 229.6 miles of road or 80.6% of the system length. This sample size was considered excessively large for economy reasons.

However, it was also found that the number of samples required could be reduced if road sections could be classified into groups which had traffic volumes falling within a relatively narrow range. This technique is known as stratification and often has the advantage of providing a lower standard error of the estimate in addition to decreasing the sample size, thus yielding a more precise estimate at lower cost.

The stratification plan adopted for this study placed all road sections into one of four volume strata: stratum 1, AADT over 1,000;

† Numbers in brackets refer to references in the bibliography at the end of this paper.

stratum 2, AADT between 400 and 1,000; stratum 3, AADT between 100 and 400; stratum 4, AADT less than 100.

Implementation of this technique, however, for the 92 county highway systems of Indiana presented several problems. Individual roadway sections for which traffic information was representative had to be selected. Each section then had to be assigned to its appropriate volume stratum. It was recognized that the AADT's of the road sections were unknown and that their placement would have to be estimated. It was believed, however, that qualified county personnel could assign road sections to their proper volume stratum reasonably well, so this procedure was followed.

Upon completion of the study, the accuracy of the estimated stratification was measured. Table 1 shows the percentage of miles which actually fell into each volume range for each of the estimated strata. The overall percentage of miles placed in their proper stratum was 60.5%. The general tendency was that volumes were slightly underestimated.

In order to reduce the cost of the study and to make its conduct practical (i.e., to complete the data collection phase during the summer months of 1966), it was decided to restrict sampling operations to approximately 25% of Indiana's 92 counties. Rather than select the sample of counties at random from the state at large, the counties were grouped so that widely differing population and size ranges would be represented.

The grouping of counties was done in the following manner. The population and registered motor vehicles in each county were summed, and this sum then divided by the county's square mile area. The resulting densities were numerically ranked and seven arbitrary groups formed from each of which a 25% sample was selected at random. This resulted in the sample of 25 counties shown in Fig. 2.

Table 1. Accuracy of Estimated Stratification

		Percent Distribution of Estimated Stratum Miles Falling Into Each Volume Class			
		1	2	3	4
Estimated Volume Stratum	1	78.4	17.1	4.5	0.0
	2	11.1	34.7	49.6	4.6
	3	1.8	6.5	63.3	28.4
	4	0.0	2.4	31.2	66.4



Fig. 2. This figure shows the location of each county in the sample and the vehicle-person density groups of each county.

In summary, the method employed was to place each road section in 25 counties selected randomly from seven county size strata into its appropriate volume stratum and select a random sample of these sections from each stratum. One short volume count was then made on

each sample selected to obtain an estimate of the system AADT. The AADT was then multiplied by the system length to obtain the vehicle miles of travel in the system.

DATA COLLECTION PROCEDURE

The data collection procedure is outlined only briefly here. The procedure consisted generally of the following steps:

1. Each of the 25 selected counties was notified of the study and its purpose and the county commissioners were asked to name a qualified county representative to act as liaison with the HERPIC staff.

2. Those roads which were state primary and secondary and federal-aid-secondary county roads were delineated on a county map. The county representative checked the map to insure its accuracy and that all unmarked roads were county roads.

3. The county representative then sectioned all county roads on an estimated traffic volume basis and placed each section in one of the four volume strata.

4. Each county stratification map was then checked by the study staff for reasonableness. Three were rejected as inconsistent and were handled in the data analysis as special cases. All road sections were measured to the nearest tenth of a mile from official county transportation maps obtained from the Highway Planning Survey of the Indiana State Highway Commission.

5. The number of counts for each stratum of each county was then determined. In general, all volume stratum 1 road sections were counted, almost all volume stratum 2 road sections were counted, and three and one volume counts, respectively, were made for each 100 miles of volume stratum 3 and volume stratum 4 road sections in each county.

6. The county representative was notified of the number of personnel required to perform the counting operation and the date on which counting would be carried out. Each county representative was responsible for arranging for the needed personnel.

7. An instructional session was held for the count personnel in each county on the afternoon preceding the count. Each person was assigned a specific location, given volume counting forms (see Fig. 3) and told exactly what had to be done. The count was made from 8:00 a.m. till noon and again from 2:00 p.m. to 6:00 p.m. for a total of 8 hours at each selected location. An automatic volume recording device was installed on each of five roads in each county during the counting period in order to determine appropriate expansion factors.

8. All data were collected and returned to HERPIC for processing and analysis.

RESULTS OF THE STUDY

The county highway system of Indiana consists of two distinct subsystems, each under county supervision. The first subsystem consists of 12,948.3 miles of federal-aid-secondary county roads while the second consists of 55,079.0 miles of non-FAS county roads. The county highway system thus totals 68,027.3 miles of road. These figures are based on the recently completed inventory of all county roads as performed under the direction of the Indiana State Highway Commission (ISHC).

COUNTY HIGHWAY TRAFFIC STUDY

County _____ Date _____ Name _____

Counting Location _____

VEHICLE CLASSIFICATION

Time	Passenger Cars	Pickup and Panel Trucks	Other Trucks	Other Vehicles
AM 8:00 — 9:00				
9:00 — 10:00				
10:00 — 11:00				
11:00 — 12:00				
LUNCH		12:00 noon to 2:00 P.M.		
PM 2:00 — 3:00				
3:00 — 4:00				
4:00 — 5:00				
5:00 — 6:00				

Fig. 3. Sample of traffic volume count form.

REMARKS:

As the Division of Planning of the ISHC conducts a continuing program of volume counts on all state and federal-aid roads, the FAS county road system was not included in the sampling operations. Traf-

fic volumes for these roads were obtained from the Division of Planning for the sampled 25 Indiana counties.

Thus, two road populations were sampled. However, since three counties submitted an unreasonable volume stratification for the non-FAS roads in their counties, these three were considered as a third population as distinguished from the other 89 counties.

FAS County Road System

Traffic volume data were available from the Division of Planning for almost all miles of FAS county roads in each of the 25 counties. These were raw data in the form of a 24-hour volume count for each road section.

Two expansion factors, growth and seasonal, were required to convert these volumes to 1966 AADT's. An average growth of 4% per year was used in order to update those counts not made in 1966.

The seasonal expansion factor, to account for the time of year when the count was taken, was estimated from Fig. 4 which is a plot of the expansion factors used by the Division of Planning to convert 24-hour weekday volumes to AADT's for local roads in rural areas. The application of these two factors to each volume produced an AADT for each road section.

Volume measurements for 3229.4 miles of FAS county roads in the 25 counties were used in providing an estimate of vehicle miles of travel

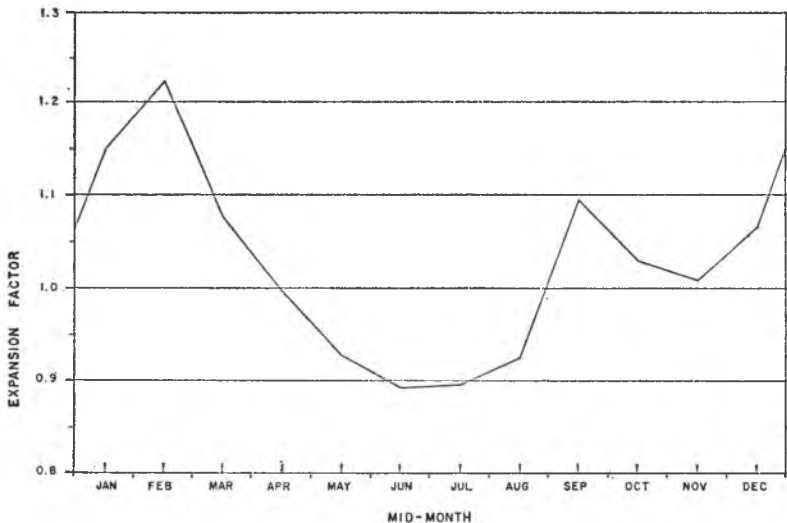


Fig. 4. Factors to expand 24-hour weekday (Monday through Thursday) volumes to AADT—local roads in rural areas.

for the 12,948.3 miles of this system. The data were analyzed as a simple random sample.

The average AADT of this system was 412.4 vehicles per day. The estimate of vehicle miles was the population total, and equaled 5.34 million per day or 1.949 billion vehicle miles per year. The estimate of annual vehicle miles of travel was computed to be within plus or minus 4.86% of the true value at the 95% confidence level. The estimates computed for the FAS county road system are summarized in Table 2.

Non-FAS County Roads—89 Counties

Since the volume stratification on non-FAS county roads of three counties was judged inadequate, the analysis described here was performed on the data collected in 22 counties and expanded to 89 of Indiana's 92 counties.

The data were collected in the form of eight hourly counts of the four vehicle classifications: namely automobiles, pickup and panel trucks, other trucks, and other vehicles. The 8-hour totals of each vehicle classification as well as the total number of vehicles were determined for each road section counted. The hourly breakdown on the data sheets served no purpose other than to insure some order in data collection.

In all, there were 748 data sets covering 1676.5 miles of road included in this portion of the analysis.

An expansion factor to convert the 8-hour counts to AADT's was determined separately for each county and applied to all counts made in the county. Each expansion factor consisted of two parts. The first was used to convert the 8-hour count to a 24-hour count and was determined in the following manner.

Five hourly recording automatic traffic counters were set out in each county. These were generally placed on paved, low volume state routes in order to be more closely indicative of county highway traffic.

TABLE 2

Summary of Estimates—FAS County Roads

Total Length—	12,948.3 Miles
Sampled Length —	3,229.4 Miles
Average Daily Traffic	
Average ADT	412.4 Vehicles Per Day
Variance	104.75
Standard Deviation	10.24
95% Confidence Interval	392.3 to 432.5

Vehicle Miles of Travel

Vehicle Miles	5,339,797 Per Day
Variance	17.562 Billion
Standard Deviation	132,523
95% Confidence Interval	5,080,000 to 5,600,000

Annual Vehicle Miles of Travel

Vehicle Miles	1.949 Billion Per Year
95% Confidence Interval	1.854 Billion to 2.044 Billion

The total recorded count for the eight hours corresponding to the eight hours of manual counting was noted (x_j , j varying from 1 to 5). The total count for the entire 24-hour period was observed (y_j). The 24-hour expansion factor, F , was then computed as

$$F = \frac{\sum y_j}{\sum x_j}, j = 1, 5$$

The second part of the expansion factor was needed to account for the time of year when the count was taken, i.e., the seasonal effect. This factor was estimated from Fig. 4. The application of these two factors to each 8-hour count produced an AADT for each road section. The factors used for each county are shown in Table 3.

Using the AADT so computed for each of the sampled road sections and standard statistical techniques, an estimate of the overall average AADT for the non-FAS county roads in 89 of the 92 Indiana counties and other estimates of travel were computed. The results are shown in Table 4.

Non-FAS County Roads—3 Counties

The analysis procedures for the data for the three counties which did not satisfactorily classify their roads was similar to that used for the 89 counties. There were 121 data sets covering 288.2 miles of road included in this portion of the analysis.

The estimates of travel on non-FAS county roads in these three counties are given in Table 5.

County Road System

The estimates for the three subsystems of the entire county road system have been described above. It remained to provide an estimate for the county road system as a whole.

TABLE 3
County Data Summary

County	Expansion Factors		County Road Miles				Number of Counts by Stratum						
	24 Hours	Sea-sonal	All Roads	Totals by Stratum				1	2	3	4	All	
				FAS Roads	1	2	3						4
Adams	2.04	0.895	692.4	194.0	0.0	3.8	38.6	456.0	0	3	14	5	22
Brown	1.95	0.904	565.3	88.6	0.0	0.0	39.7	437.0	0	0	15	5	20
Clay	2.02	0.894	719.9	145.9	3.0	5.4	88.9	476.7	4	7	18	6	35
Dearborn	2.04	0.918	529.9	77.9	0.0	11.6	74.9	365.5	0	4	13	5	22
Dubois	2.09	0.895	720.2	121.7	0.0	7.8	47.8	542.9	0	6	18	6	30
Elkhart	1.96	1.060	1011.4	134.8	26.7	114.4	162.9	572.6	15	18	22	7	62
Fayette	2.09	0.920	374.4	92.0	0.0	4.2	66.3	211.9	0	3	9	3	15
Franklin	1.98	0.920	717.7	129.1	0.0	0.0	68.6	520.1	0	0	18	6	24
Fulton	1.97	0.948	774.9	153.4	1.1	80.6	241.1	298.7	1	20	17	5	43
Howard	2.06	0.977	642.9	171.1	2.7	19.2	67.7	382.2	4	13	15	4	36
Jefferson	2.00	0.918	605.9	84.7	0.0	8.6	262.9	249.7	0	11	15	5	31
Kosciusko	1.96	0.910	1160.7	166.2	0.0	9.0	363.8	621.7	0	6	30	10	46
Lawrence	2.15	0.901	708.7	130.4	0.0	34.5	122.4	421.4	0	16	15	4	35
Monroe	2.18	0.903	739.0	171.9	10.1	37.3	103.7	416.0	6	16	16	5	43
Montgomery	2.03	0.910	869.3	201.8	0.0	18.9	183.8	464.8	0	14	20	6	40
Perry	2.12	0.895	589.9	60.5	0.0	1.7	20.4	507.3	0	1	11	10	22
Posey	2.01	0.895	801.9	113.7	0.0	8.5	118.2	561.5	0	2	21	7	30
Steuken	1.90	0.937	644.4	70.7	0.0	22.1	257.4	294.2	0	19	16	5	40
Vanderburgh	2.13	0.895	509.9	151.2	9.7	40.0	59.6	249.4	8	17	11	2	38
Washington	1.98	0.901	842.5	116.4	0.0	31.6	199.0	495.5	0	15	21	7	43
Wayne	2.14	0.925	715.5	204.1	0.0	40.3	279.8	191.3	0	16	11	4	31
White	1.95	0.910	881.3	211.3	0.0	15.2	122.3	532.5	0	13	20	7	40

TABLE 4

Summary of Estimates—Non-FAS County Roads—89 Counties	
Total Length—89 Counties	53,108.0 Miles
Sampled Length—22 Counties	1,676.5 Miles
Stratified Estimates	
Average Daily Traffic	
Average ADT	151.6 Vehicles Per Day
Variance	17.6
Standard Deviation	4.195
95% Confidence Interval	143.4 to 159.8
Vehicle Miles of Travel	
Vehicle Miles	8,052,013 Per Day
Variance	49.629 Billion
Standard Deviation	222,775
95% Confidence Interval	7,615,373 to 8,488,653
Annual Vehicle Miles of Travel	
Vehicle Miles	2,939 Billion Per Year
95% Confidence Interval	2,780 to 3,098 Billion

TABLE 5

Summary of Estimates—Non-FAS County Roads—3 Counties	
Total Length—3 counties	1971.0 Miles
Sampled Length—3 counties	288.2 Miles
Stratified Estimates	
Average Daily Traffic	
Average ADT	166.7 Vehicles Per Day
Variance	280.0
Standard Deviation	16.73
95% Confidence Interval	133.9 to 199.5
Vehicle Miles of Travel	
Vehicle Miles	328,627 Per Day
Variance	1,088 Billion
Standard Deviation	32,984
95% Confidence Interval	263,979 to 393,275
Annual Vehicle Miles of Travel	
Vehicle Miles	119.9 Million Per Year
95% Confidence Interval	96.4 to 143.5 Million

A simple way to do this was to consider each subpopulation as a stratum and then use the normal estimates for stratified random sampling. Since two of the subpopulations already consisted of four strata each, while the third consisted of a simple random sample, the combined county road system was considered as consisting of 9 strata.

The average AADT for the combined county road system was estimated by simply dividing the total daily vehicle miles on the three subpopulations by the total length in miles. These values are given in Tables 2, 4, and 5. This calculation:

$$\frac{13,720,437.7}{68,027.3}$$

yielded an average AADT of 201.7 vehicles per day.

The vehicle miles per day are, of course, the numerator of the above expression. The variance of vehicle miles was estimated by summing the variances of vehicle miles for the three subpopulations. This sum is approximately 68.279 billions, so that the standard deviation of vehicle miles is about 261,300.

The variance of the average AADT was obtained by dividing the variance of vehicle miles by the square of the total length in miles. This calculation produced a variance of 14.8 and a standard deviation of 3.84.

The estimate of annual vehicle miles of travel was 5.008 billion. The 95% confidence interval was plus or minus 186.9 million. This estimate was calculated to be within plus or minus 3.7% of the true value at the 95% confidence level.

The estimates for the combined county road system are summarized in Table 6.

Fig. 5 shows the complementary cumulative distribution of road miles and vehicle miles as a function of AADT for the combined county

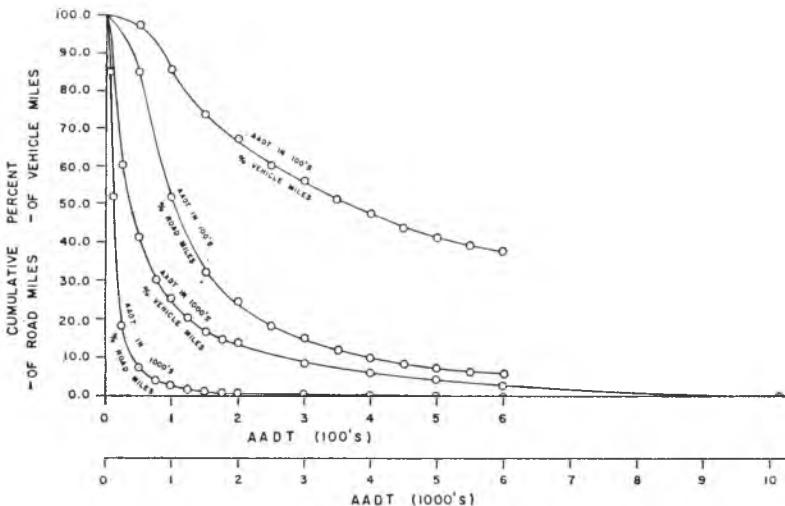


Fig. 5. Road miles and vehicle miles plotted as a function of AADT—complete county road system.

road system. About 50% of the vehicle miles are driven on the 11.5% of the road miles with an AADT of about 370 vehicles per day or more.

The concentration of vehicle traffic is illustrated in Fig. 6. Here the complementary cumulative distribution of vehicle miles of travel is plotted versus that of road miles. The curves for FAS roads, non-FAS roads, and the complete county road system are virtually identical in shape and placement. However, it must be noted that the AADT's relative to each curve are quite different.

Vehicle Classification

The analysis of vehicle classification was restricted to the data collected on non-FAS county roads in the 22 counties where stratum classification by volume was considered reasonable.

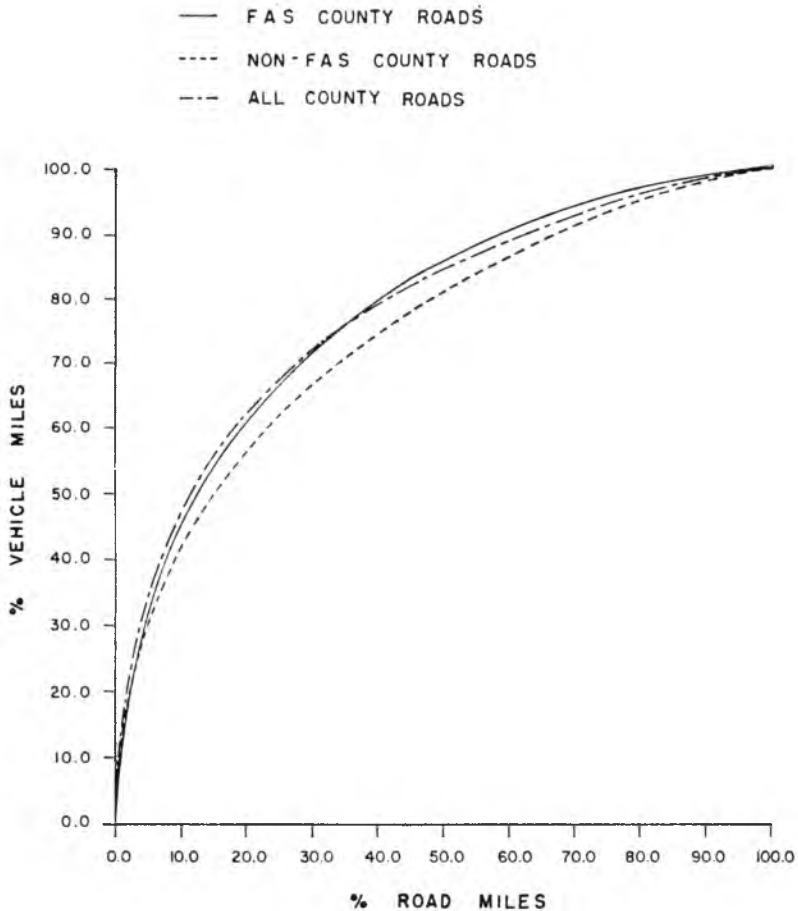


Fig. 6. Concentration of Traffic.

The 8-hour total of each vehicle classification type for each data set was first multiplied by the appropriate expansion factors for the individual counties from Table 3. The average number of each vehicle type within each stratum was then computed, this average being weighted by the length of each road section. The percent of each vehicle type within each stratum was then computed with the results shown in Table 7.

It can be observed that 66.7% of the vehicles on county roads are automobiles, 19.3% are pickup and panel trucks, 8.2% are other trucks and 5.9% are other vehicles.

It was also noted that as the traffic volume increases, the percentage of automobiles in the traffic stream increases while the percentage of all other vehicle types decrease. The percentages found for each stratum were plotted versus the average volume of that stratum as shown in Fig. 7. From this figure it is possible to pick off an estimated vehicle classification for any known volume on non-FAS county roads.

TABLE 6

Summary of Estimates—All County Roads

Total Length	68,027.3	Miles
FAS Roads	12,948.3	Miles
Non-FAS Roads	55,079.0	Miles
Sampled Length	5,194.1	Miles
FAS Roads	3,229.4	Miles
Non-FAS Roads	1,964.7	Miles
Average Daily Traffic		
FAS Roads	412.4	
Non-FAS Roads	151.6	
All County Roads	201.7	
Variance	14.8	
Standard Deviation	3.84	
95% Confidence Interval	194.2 to 209.2	
Vehicle Miles of Travel		
FAS Roads	5.340	Million Per Day
Non-FAS Roads	8.381	Million Per Day
All County Roads	13.720	Million Per Day
Variance	68.279	Billion
Standard Deviation	261,300	
95% Confidence Interval	13.208 to 14.233	Million

TABLE 6 Continued

Annual Vehicle Miles of Travel

FAS Roads

1.949 Billion Per Year

Non-FAS Roads

3.059 Billion Per Year

All County Roads

5.008 Billion Per Year

95% Confidence Interval

4.821 to 5.195

Billion Per Year

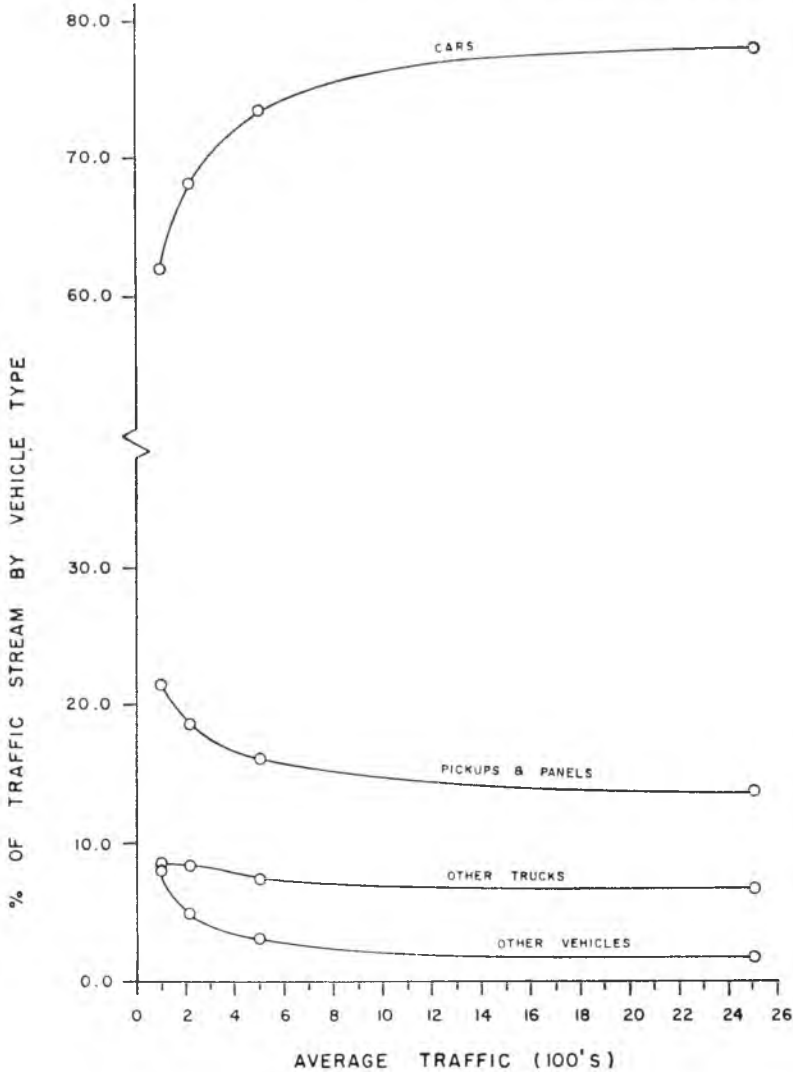


Fig. 7. Vehicle classification shown—percent of vehicle type by average AADT of each stratum.

TABLE 7
Vehicle Classification

Stratum	Vehicle Type (% Within Each Stratum)			
	Cars	Pickups and Panels	Other Trucks	Other Vehicles
1	77.9	13.7	6.7	1.7
2	73.5	16.1	7.4	3.1
3	68.2	18.6	8.3	4.9
4	62.0	21.4	8.5	8.0
all	66.7	19.3	8.2	5.9

CONCLUSIONS

Indiana's County Highway System of 68,027 miles carried an estimated 5.008 billion vehicle miles of travel in 1966. The 95% confidence interval on this estimate is from 4.821 billion to 5.195 billion vehicle miles of travel per year.

Of the total 5.008 billion vehicle miles, approximately 1.949 billion (39%) were traveled on federal-aid-secondary county roads totaling 12,948 miles (19% of all county roads). The remaining 3.059 billion vehicle miles (61%) were traveled on non-FAS county roads totaling 55,079 miles (81% of all county roads).

The average 1966 AADT for all county roads was 202 vehicles per day with an average of 412 per day on FAS county roads and 152 per day on non-FAS county roads.

The percentage of county road mileage carrying various ranges of daily traffic volumes (AADT) is estimated to be as follows for 1966:

RANGE OF AADT

	Under 100	100 to 400	400 to 1,000	Over 1,000
FAS Mileage	21.4%	51.8%	18.4%	8.4%
Non-FAS Mileage	54.8	39.3	4.7	1.2
All County Roads	48.2	41.8	7.4	2.6

About 48% of all county roads were found to carry less than 100 vehicles per day and over 21% of all present FAS county roads carried

this low volume. On the other hand only 10% of the county roads carried more than 400 vehicles per day and many of these miles of heavy volume roads—over 6000 miles—were not in the FAS system while over 2400 miles of the FAS system carried less than 100 vehicles per day. It of course, is true that some low volume FAS system roads are necessary in order to maintain a system, but the high mileage of low volume roads in the FAS system and so many miles of high volume roads not in the system indicates that a serious look needs to be taken at present county road classification by many counties. The buliding of a county road to the high standards of the FAS system when it carries less than 100 vehicles a day might well be unwise use of county highway funds.

The annual vehicle miles carried on each of the four volume ranges of county road noted as percentage of the total vehicle miles of travel on county roads was found to be as follows:

RANGE OF AADT

	Under 100	100 to 400	400 to 1,000	Over 1,000
FAS Mileage (County)	3.3%	28.1%	26.8%	41.8%
Other County Roads	22.1	44.6	18.6	14.7
All County Roads	14.6	38.0	21.9	25.5

Using the information in the two tabulations given above, some interesting comparisons may be made. About one-half of all vehicle miles traveled on county roads is carried on the 10% of the mileage having traffic volumes greater than 400 per day. Certainly these volumes deserve a high type of county highway. Only about 15% of the vehicle miles are carried on the almost 50% of the road mileage carrying less than 100 vehicles per day. These roads, because of their low volume, cannot normally justify heavy expenditures to rebuild them to high standards. All county roads should be all-weather and possibly dust-proof but they cannot all be hard surfaced if current funds are to be wisely used. A classification of all county highways into systems based primarily on average daily traffic volume (AADT) is necessary if county highway officials are to decide wisely which roads to improve in their system.

The classification of vehicles by percent for non-FAS county roads is estimated to be as follows for 1966: 67% automobiles; 19% light trucks; 8% other trucks; and 6% other vehicles.

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