TOTAL TRAVEL IN NORTH CAROLINA MUNICIPALITIES[1]

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SYNOPSIS

To accomplish the basic objective of determining total vehicle miles of travel on all municipal streets in North Carolina, six "sample" cities and towns were selected for complete coverage by traffic count machines and short count manual methods, the latter being based on special studies as to technique.

Data were analyzed and classified by street systems, types, and portions of town; and were adjusted for seasonal effect for calendar year 1949.

Using population 1940 and 1950, and street mileage as control factors, data were expanded from the "sample" towns to all municipalities in the State. Results were reconciled as near as possible with vehicle-mile data on rural systems, and compared to total gasoline consumption; and finally expressed in terms of percentage of gasoline which is consumed in total municipal travel.

The major conclusion is that about 34 percent of taxed gasoline consumed by motor vehicles on public roads and streets in North Carolina, in 1949, was consumed on municipal streets, 48 percent on rural State Highways and 18 percent on County Roads.

For many years, through the State-wide Highway Planning Survey, which is handled by the Statistics and Planning Division in North Carolina, rather complete information on the traffic usage of the County Road and State Highway Systems in all rural areas throughout the State have been compiled. For example, complete vehicle mileage data on all rural systems in all counties, in detail and in tabular analysis form have been available.

However, within the towns and cities the data have been rather limited. No town officials have known exactly the mileage of all of the streets in their town catalogued in terms of types and widths, and no town has had data as to the total vehicle-miles of travel throughout any city or town. In the same way, the State did not have this information in municipalities.

Because of increasing Federal and State Aid to cities and towns in street construction and in street maintenance in North Carolina, and because of certain current Administrative and Legislative studies in this State aimed at determining the proper fiscal relationships between Federal, State, and City governments in the field of traffic facilities, such as street construction, maintenance, and traffic operations; it became apparent in 1948 that it would be advisable to obtain more complete data and estimates on the vehicle-miles which were traveled in all of the municipalities in the State.

There being about 489 incorporated places in North Carolina, it was apparent that it would be impossible to obtain traffic data on every block of every street in every town. A study of completed research and available information from various associations and research agencies in the United States revealed that very little information was available on complete vehicle-mileage data within cities and towns. Likewise, it was impossible to find that any definite relationships had been determined which would permit direct expansion in North Carolina on a population or street mileage basis.

However, it was considered feasible, within limits, to select representative cities and towns in North Carolina and to obtain complete vehicle-mile data on all sections of all streets in such towns; and, by means of expansion, controlled on miles or on population, to make a reasonable estimate of the total vehicle-miles of travel in all North Carolina cities and towns. To do this, it was necessary, of course, to select certain typical or representative towns. It was also necessary to develop a technique which was both reasonably accurate,

[1] This is a condensed version of the original report which contains many charts and tables offering data in support of the findings reported herein.

practical, safe, and reasonably cheap, to obtain the basic information. In this report, the steps which were taken in these respects and to report the findings of the study are described in detail.

Selection of Representative Municipalities—The 489 incorporated places in North Carolina vary in size from a few dozen population up to slightly more than 100,000 (1940). It was considered advisable to give special treatment to all places having a population of less than 2,500, since these very small places have a traffic pattern which is greatly affected by the existence of highways and the impact of highway traffic, and because there are so many local conditions which make it impossible for these small towns to have any common pattern of traffic movement. Estimations were employed for this coverage. They are described later in the report. Having eliminated these towns, there remained 76 from which to choose representative or sample towns and cities.

A line graph was prepared and 1940 population was plotted on the vertical axis for all of these municipalities varying in size from 2,500 to 100,000. In a few special cases revised population estimates were employed. The plotting of this graph showed groupings or clusters of towns at various points on the graph. One of these clusters occurred between 45,000 and 80,000. Within this group several cities were eliminated as having various abnormalities, and the City of Greensboro was selected as being more representative than any other city of this population group. A second check was made by comparing the per capita street expenditure of Greensboro during 1948 with the per capita expenditure of all Cities in its population group, as ascertained from the Municipal Fiscal Survey. It was found that Greensboro's expenditure and the average expenditure for cities in this population bracket were almost identical.

The second cluster was noted between 22,000 and 45,000 population. There were only four towns within this group, and two of these, (Burlington and Fayetteville) had experienced war-time booms and therefore were not considered as representative on the 1940 population basis. Of the remaining two towns, Rocky Mount appeared to be the best choice, and a comparison of its per capita expenditure was favorable. Therefore Rocky Mount was chosen for the second group. In the same way, representative towns were chosen for the three other groups.

Later on, during the course of the study, a situation developed which made it practical to include the town of Hickory. Thus a sixth town became a sample town for the purpose of this study. Hickory and Concord both fell within the size grouping of 12,000 to 22,000 and it is noted that there were 26 municipalities of this size. Therefore, there are two towns representing the 26, instead of one.

For towns below the 2,500 size, a special estimation technique was employed. This technique will be outlined later in the report.

Field Work on Street Mileage—Having determined the towns to be used as sample or representative towns, the next step was to obtain exact layout data as to streets, street types, street widths, and traffic characteristics. Accordingly, the most recent city maps were obtained from each of these towns. Field work was started first with the smallest town, working to the largest.

For example, in the case of Clinton, the town map was obtained and a one-man party took the map to the field and covered every block of every street in the town. He made various changes and corrections to bring the map up to date with respect to usable streets, their location, etc., and to eliminate certain streets which were shown on the map, but which did not actually exist on the ground.

The next step was to make actual measurements of the streets themselves. An odometer reading to hundredths of a mile was used to check on the accuracy of the map scale. The widths of streets between curbs were measured by tape in every block, and these data were recorded block by block. At the same time, the apparent surfacing type of the street was recorded as being either high type hard surface, low type hard surface, sand-gravel, or unimproved. This portion of the field work having been completed, the map was then brought in and detailed schedules were worked up for the traffic count coverage of every block of every street in the town.

Study of Methods for Traffic Count Coverage—A review of research material and published statistical reports throughout the United States revealed very little data as to vehicle mileage on a city-wide basis anywhere and very few reliable relationships could be ob-

tained between total vehicle-miles on the one hand and the total population or total street mileage on the other. Because of the very large number of places where traffic counts would be necessary for complete city-wide coverage it was considered advisable to explore the advantages of repeated short-count methods, with counts as short as five to ten minutes each. Information was obtained concerning procedures used in Albuquerque, New Mexico; in St. Louis, Missouri, and in several other places. It was found that some theoretical work had been done by Professor Vickery in Texas indicating the soundness of repeated short counts. An article was also noted on page 499 of the August 1948 issue of *Traffic Engineering* referring to short-count traffic work done in Fort Wayne, Indiana. In this case, the counts were of five-minute duration and the accuracy appeared to be very good.

Accordingly, a series of tests were made here in Raleigh, North Carolina, of the six-minute method, over a period of two weeks. As noted in Table 1 a typical business street (not Main Street, and not on a highway or arterial) was selected and used to test the six-minute counts repeated eight times a day, against a continuous traffic recording machine operated by the same traffic. It is noted that this was done on nine weekdays, from 8:00 A. M. to 4:00 P. M. (with one exception).

It is noted that the individual errors ran from minus 4.2 to plus 12.8 percent, with a net error of plus 5.17 percent. Such is the effect of compensation on repeated tests on a given street.

There were great economic advantages to the use of the short-count method wherever traffic volumes were high enough to warrant stability. An analysis of field costs of both short and 24-hr. machine methods showed the latter would cost 3.6 times as much as the 6-min. short count repeated 8 times in 8 hours.

For these reasons, it was decided to adopt the short-count method where expected 24-hr. vehicle volumes were as high as 400, and where short-count stations could be grouped together in clusters of 6 within short walking distances. On all other streets, the 24-hr. cumulative traffic count machines were employed. Both types of station were controlled for expansion by hourly recording machines, there being two recorder stations for about twenty counted stations.

The 24-hr. non-recording machines were installed by men traveling in panel trucks. The short six-minute counts were made by men on foot; although in some cases, they found it possible to use cars to cover the distance between stations quickly. This same procedure, basically, was followed in all of the six towns in the survey. In many cases, the personnel of the city helped in certain respects, and in all cases the regular traffic machine personnel of the State Highway Commission were brought into the town to help with field work for a period of one to one and one-half weeks, depending on the size of the town and the magnitude of the coverage.

Analysis—The six-minute traffic data were computed for the 24-hr. period as controlled by traffic recorders, and the 24-hr. machine count data were likewise expanded as based on the control recorder data. This resulting 24-hr. data were then posted on maps block by block for each street. In many cases, it was apparent that the data were in error and some further investigations and adjustments were necessary. Additional field work was done to make such adjustments. The traffic data thus represented the 24-hr. week day of the period covered by the survey (one to two weeks). No attempt was made at this point to make seasonal or annual adjustments. This was done at a later date, as described later in this report.

At this stage, the maps had been posted with traffic data as well as type and width data for each section of each street. Punch cards were then employed to carry the data into punch card equipment. Columns on traffic count and length of section were multiplied by each other to obtain vehicle-miles on each section (usually one block). Further analyses and tables were made from this data, representing the basis for the tables which follow in this report.

Seasonal Adjustment—The total time covered by the original traffic counts in these five or six towns covered a gross time period of over 12 months. Thus, it was advisable, in order to make seasonal adjustments, to make some additional counts in these towns. This was done, several months after the original counts were made, at the control stations and the data were adjusted for seasonal and annual changes. The adjustment is reflected in final adjusted

tables in terms of the average 24-hour day for the calendar year 1949.

The tables present the summarized basic data and, hence, may be of special interest for use in many municipalities in the nation. Certain relationships presented are believed to represent new research data in this field. For example: there is much uniformity in the vehicle-miles per mile, or average traffic density, in the various towns, regardless of size. There are dozens of relationships and correlations which may be used as indicators in traffic estimation work in municipalities throughout the nation.

mileage in a large number of towns and cities. These were checked in general against certain data which were available in the office of the State-wide Highway Planning Survey. In the smaller towns, that is under 2,500, there were so little mileage data available that it was considered advisable to obtain such data by field measurements. Accordingly, in connection with our reinventory work, complete mileage data were obtained in the field for about 25 small towns in the Central and Eastern portion of the State. These mileage data could then be expanded within mileage group brackets to obtain estimated figures for

TABLE 1

RELATIVE ACCURACY OF REPEATED SHORT COUNTS AND FULL TIME MACHINE COUNTS, BUSINESS STREET IN RALEIGH, N. C.

Part of Hour[a]	Date 1949 Aug.	Full Time Machine Count			Eight Short Counts of Six Minutes Each Total 48 Minutes		Error
		Period	Minutes Duration	Vehicles	Exp. Factor	Vehicles	
10–16	Tues. 9	8.00–5:20	560	2,239	11.66	2,485	+11.0
20–26	Wed. 10	8:00–5:20	560	2,310	11.66	2,495	+ 8.0
30–36	Thurs. 11	8:00–5:20	560	2,420	11.66	2,729	+12.8
40–46	Fri. 12	8:00–5.20	560	2,373	11.66	2,274	− 4.2
40–46	Mon. 22	8:00–5:20	560	2,670	11.66	2,623	− 1.8
30–36	Tues. 23	8:00–5 20	560	2.736	11.66	3,023	+10.5
20–26	Wed. 24	8.00–5:20	560	2,572	11.66	2,821	+ 9.7
10–16	Thurs. 25	8 00–5:20	560	2,603	11.66	2,521	− 3.2
10–16	Fri. 26	8:00–4 00[b]	480	2,317	10.00	2,420	+ 4.5
				22,240		23,391	

[a] 10–16 means six-minute count 8:10 to 8:16 and 9:10 to 9.16, etc. throughout day, etc.
[b] New car showing crowd after 4:00 P. M. August 26. Count discontinued.

There was an average daily usage of all streets of about 1,089 vehicles per mile of streets, for almost any size of town. Of course, one should not use an average such as 1,089 vehicles per mile for a State-wide expansion, but a comparison of average usage per mile does indicate a correlation between street miles and total vehicle-miles, at least in geographically isolated towns and cities, such as all these are.

Mileage Control—Data were obtained from various sources to obtain the total mileage in all of the 489 incorporated places in North Carolina. In the vast majority of those towns authorities had very little reliable data. However, in connection with the work of the State-Municipal Road Commission, and through the cooperation of the North Carolina League of Municipalities, it was possible to obtain rather careful up-to-date estimates of total street

total street mileage in all such towns throughout the State (Table 2). It is believed that the element of compensation is present in these expansions, and that the result is a very close estimate of the total street miles on all systems in all towns in North Carolina (i.e., 6933.7 miles).

Method Of Expansion—The only State-wide data generally available are:

1940 Population
Preliminary 1950 Population (part)
Total Street Miles (partly estimated)
Miles on State Routes in Towns
Miles on County Road Extensions in Towns

With the objective being an estimate of total vehicle miles in all North Carolina towns, one may consider the merits of usage of the above as bases for expansion.

Since the sample towns were not chosen strictly in accordance with principles of ran-

dom sampling, the use of standard deviations would not be an appropriate statistical test. There is no guide available in completed research indicating whether population or miles would be a more reliable basis for expansion, or whether some other method might be more desirable.

It is noted that the totals fall very close to each other in the three methods above, indicating that there may be merit in all of these methods, and that the sample towns are reasonably representative.

Another method (4) would also be based on mileage, as follows: Expand separately by town size groups, separately for State Highway streets, and all *other* streets. By this method, Table 4 may be computed.

To summarize, then, four methods of expansion have been considered, resulting as follows:

		Percent Deviation
Method-Basis:		
1. Pop. 1940	7,051,907	+1.42
3. Total Street Miles	6,803,740	−2.10
2. Pop. 1950	6,992,444	+0.50
4. Combination Mileage	6,963,309	+0.10
Mean	6,952,850	1.03

The presence of, or lack of, intensive suburban development, especially of an industrial nature, may greatly affect the volume of travel in the town. Other factors may be the proximity of other towns, intensity of rural population, importance of through highway streets as traffic arteries, economic factors, available mass transport, etc.

Using three methods, one may expand to State-wide values, using total population in all towns of Class A, or total street miles of all towns in Class A, etc., as expansion factors, as shown in Table 3.

TABLE 2
BASIC SUMMARY DATA

1940 Populaton	Group	Rep. Town	Population		Mileage			
			1940	1950	Non System	S.H.	C.R.	Total
Over 45,000	A	Greensboro	443,435	526,760	1,254.5	139.2	131.6	1,525.3
22,000–45,000	B	Rocky Mount	116,063	126,674	384.5	50.7	40.1	475.3
12,000–22,000	C	{Concord / Hickory}	159,456	186,043	582.3	82.3	45.6	710.2
7,000–12,000	D	Washington	142,515	166,376	545.3	84.1	69.1	698.5
2,500–7,000	E	Clinton	163,335	188,208	705.4	141.0	136.8	983.2
1,000–2,500	F	None	143,825	172,713	694.5	205.6	226.8	1,126.9
Under 1,000	G	None	133,134		506.7	370.2	537.4	1,414.3
Total[a]			1,301,763		4,673.2	1073.1	1187.4	6,933.7

[a] Totals for all Incorporated places in the State.

TABLE 3
EXPANDED DATA
(All Towns, 1949 24-Hour Daily Vehicle Miles)

Town Class	VM per pop. 1940 Method 1	VM per tot. Miles Method 2	VM per pop. 1950 Method 3
A	2,106,316	2,012,223	1,725,114
B	461,128	461,094	482,430
C[a]	885,938	955,331	847,979
D	558,659	582,160	662,877
E	919,576	856,346	1,030,394
F[b]	1,018,281	1,018,281[c]	920,677
G[b]	1,107,009	1,107,009[c]	1,134,269
Total vehicle miles all towns	7,051,907	6,992,444	6,803,740

[a] Average values used for Concord and Hickory, both being in same size group.

[b] Derivation of these values are explained in Appendix 1.

[c] From Method No. 1; 1950 Pop. data lacking for small towns.

TABLE 4
METHOD 4. VEHICLE MILE EXPANSION

Class	All State Highway Streets	All Other Streets	Total All Towns
A	568,632	1,171,255	1,739,887
B	281,741	255,185	536,925
C	526,555	435,763	962,318
D	334,466	446,054	780,520
E	489,246	408,467	888,713
F[a]			920,677
G[a]			1,134,269
Total			6,963,309

[a] Lacking complete reliable data, use estimate from Method No 3.

Summary—It is clear that these various expansion methods give results which are remarkably close to each other, the maximum deviation from the mean being 2.10 percent. It is granted that the F and G town data were repeated in each of two of the cases and is, therefore, common to each pair (These small town data are the weakest portion of the study.).

Lacking any indication as to which of the four available methods may be the most reliable, and noting the small deviation from the mean in all, perhaps the best procedure would be to simply adopt the average result from the four methods with a figure of 6,952,850 as the total 24-hr. daily vehicle-miles traveled in all incorporated places in North Carolina, on the average day of 1949.

It may be noted that this vehicle mileage on a total street mileage of 6,933.7 would give a grand average of 1,003 vehicles per day as the average traffic. An average of 1,089 daily vehicle-miles per mile for the six sample towns of over 2,500 population (1940) has been previously noted. A comparison of the 1,003 and the 1,089 represents a reasonable check, both in size and in direction, and makes the result above appear quite logical.

From other studies we have rather complete and reliable estimates of total daily vehicle miles on rural systems. Using these and the above municipal estimate, the totals on measured systems then become:

		Daily VM	Percent
(X)	Rural State Highways	12,320,610	51.56
(Y)	Rural County Roads	4,620,400	19.34
(Z)	All City and Town Streets	6,952,850	29.10
		23,893,860	100.00

Of course, it is recognized that there is some additional travel on wood and farm trails, lumber trails, on non-system park roads, in military areas, the Blue Ridge Parkway, driveways, on private property, and the like. There is no way to estimate this without reference to total gasoline consumption, and even this requires certain assumptions.

To evaluate such non-measurable travel, an analysis was made of total gasoline consumption, with due weight being given to non-taxed, refunds, truck consumption and the like, and the totals become:

Millions VM Daily		Percent
12.321	Rural State Highways	45.73
4.620	Rural County Roads	17.15
6.953	All City-Town Streets	25.80
3.051	Elsewhere (Other)	11.32
26.945		100.00

Conversion of Vehicle Miles to Gasoline Consumption—Such studies as are available indicate the urban rate in miles per gallon to be about 20 percent less than the rate in rural areas, due mainly to congestion, traffic signal stops, waits, and starts, parking consumption and the like. Using the figure of 12.84, as determined above, one may solve for the rates and present the data as in Table 5.

TABLE 5

Travel On	Rate	Millions of Vehicle Miles Daily	Daily Gasoline Consumption	Percentage in Group
	mpg		*gallons*	
State Highways Rural	13.774	12.321	894,511	42.624
County Roads Rural	13.774	4.620	335,415	15.983
All City-Town Streets	11.019	6.953	631,001	30.067
Others (Elsewhere)	12.836	3.051	237,691	11.326
Total.		26.945	2,098,618	100.000

The percentages in Table 5 then represent the major result of this study—the first such study of its kind in North Carolina, and perhaps the first so complete in the nation.

There remain elements of weakness as follows:

1. Assumptions were necessary in length of town streets, especially in many small towns.
2. Minimum traffic coverage in small towns.
3. The 11.33 percent unaccountable vehicle mileage encompasses many unknown elements of gasoline usage, and may indicate that sufficient weight has not been given to the other three "known" to cover football traffic, weekend beach traffic, special event days, and other very high, but infrequent abnormal peaks.

Conclusion—Taxed gasoline consumed by motor vehicles on public roads and streets in North Carolina, on the average 24-hour day of 1949, is found to be as follows, within the

limits as explained in the report:

	Gallons Daily	Percent
All City and Town Streets	631,001	33.91
State Highways (Outside Towns)	894,511	48.07
County Roads (Outside Towns)	335,415	18.02
	1,860,927	100.00

Consistency—National estimates have indicated that about 50 percent of travel is in municipalities, and census data show that about 50 percent of the nation's population has been urban. Since about 36 percent of North Carolina's population, in 1940, was in incorporated places, the above 33.91 percent of total travel in North Carolina Municipalities would appear to be reasonable and consistent with National estimates on a proportionality basis.

Personnel—The above survey, study and report were under the direct supervision of James S. Burch, Engineer of Statistics and Planning; aided by L. V. Jay, B. L. Ross, E. H. Tyndall, Jr., and other personnel of the Division of Statistics and Planning of the North Carolina State Highway and Public Works Commission, in cooperation with the Unites States Bureau of Public Roads.

DISCUSSION

S. M. RUDDER, *Missouri State Highway Department*—As described in this paper, traffic volumes on streets were established by securing six-minute traffic counts eight times per day in each block of six sample cities. In Missouri, we have attempted to secure acceptable traffic volumes by short term counts with an ultimate idea of computing vehicle miles and establishing a factor that could be applied to other cities of like population.

In the summer of 1949, we made a traffic count on all streets of the City of St. Louis. In this survey, a one-hour manual count was taken at every other intersection and the volume recorded on each leg of the intersection. Mechanical traffic recorders of the 15-min. recording type were placed on all types of streets in the neighborhood where these counts were taken. These recorders were allowed to operate for 24 hours. One-hour manual counts were adjusted to a 24-hr. traffic volume based on the corresponding mechanical recorder counts. Very close checks were obtained on streets, as the one-hour counts were never over two blocks apart.

Both the field and the office work of this survey were done by university students during summer vacation under the supervision of an assistant professor of Civil Engineering of Washington University.

In other cities in the state, the short term count was not used, but instead, mechanical traffic recorders of the cumulative type were operated for 24-hr. period. Locations were selected on all streets which would, in the engineer's judgment, give the average traffic along the street. These locations were from two to eight blocks apart. During the operation of the cumulative recorders, 15-min. self-recording traffic recorders were placed at key points over the city to provide a basis for adjusting the various daily traffic counts to a common day basis. This traffic was applied to the mileage of the city streets in order to provide the vehicle miles travelled.

It was found that St. Louis, Missouri, which had a 1950 population of 852,600 had 4.4 daily vehicle miles per capita. In Kansas City, a city of 453,290 population based on the 1950 census, the daily vehicle miles per capita figure was 5.25. St. Louis County had a population of 404,355 according to the 1950 census with a greater part of this population residing within five miles of the city limits of the city on the Missouri side of the Mississippi River. Approximately 386,000 people live on the Illinois side of the River adjacent to St. Louis. Of course, not all of these people work or shop in St. Louis every day, but what effect this influential population has on the traffic within the city limits of St. Louis has not been determined. Kansas City, in its metropolitan area, has a similar population effecting miles of travel on the city streets of Kansas City, but again, the effect has not been determined.

In St. Joseph, a city of 75,000 population, the figure for daily vehicle miles per capita was found to be 4.1. In Springfield, a city of 60,000 population, the figure was 5.1, and in Joplin, a city of 40,000, it was 6.2. Joplin was the only city with over 6 vehicle miles daily per capita.

Two cities, one of 20,000 and the other of 25,000 population had 3.25 and 4.0 daily vehicle miles per capita.

The figures for 13 other cities were as follows:

Population	*Daily Vehicle Miles per Capita*
16,000	5.5
13,000	3.7
11,800	2.4
11,600	5.7
11,000	5.4
10,000	2.1[a]
9,300	4.1
8,600	4.3
8,600	3.25
8,500	2.7
6,800	3.8
5,000	3.4
4,000	4.6

[a] The lowest.

In comparing these results with those found in North Carolina as described by Mr. Burch's paper we find:

Greensboro was the largest city with 73,000 population which had 4.75 vehicle miles per capita. In Missouri, St. Joseph had 4.1 vehicle miles per capita, and Springfield had 5.1 vehicle miles per capita, or an average of 4.56.

In North Carolina, Rocky Mount had a 27,000 population and 3.93 vehicle miles per capita. In Missouri, one city of 25,000 population had 4.0 vehicle miles per capita.

In Concord and Hickory, North Carolina, with a population of 17,000 and 15,000 respectively, the figures were 5.40 and 5.71, respectively. In Missouri, a city of 16,000 population had 5.5 vehicle miles per capita

These comparisons show that there is not too great a variation in the figures for vehicle miles per capita for North Carolina cities and for Missouri cities of similar population.

Quite a variation was found in some of the Missouri cities of lesser population. Three were found to have between 2 and 3 vehicle miles per capita. One had 11,800 population, one had 10,000 population, and one 8,500 population. The other cities above 4,000 population varied from 3.4 vehicle miles per capita to 5.7 vehicle miles per capita.

Most of the larger cities in the state have been worked and we believe we have sufficient sample and data to apply a vehicle mile factor to all cities in the state over 5,000 population However, in cities under 5,000 population, we will have to secure additional traffic data to arrive at a fair estimate of vehicle miles travelled in cities of this size. Only 20 percent of the urban population is found in cities under 5,000 population and, consequently, it is estimated that the percentage of total vehicle miles traveled in the cities in this population group will be correspondingly small compared to the total traveled in all Missouri municipalities.