

Interregional Stability of Household Trip Generation Rates from the 1986 New Jersey Home Interview Survey

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The geographic stability of trip generation rates is a major factor in determining data collection strategies. Expensive home interview trip diaries need be collected only in specific geographic areas if the resulting trip rates will be different from those of other areas already surveyed. In the fall of 1986, the New Jersey Department of Transportation, through a consultant, conducted a statewide small sample telephone home interview survey. This survey was divided into two independent parts, northern New Jersey and southern New Jersey, each consisting of about 1,400 household interviews. Differences in home-based trip generation rates tabulated for the areas studied, including the urban and rural portions of the southern study area, provide valuable insight into the geographic stability of trip generation rates, because these areas differ significantly in character. In a summary of the results of a comparative trip generation rate analysis for the New Jersey surveys, stratification schemes are tabulated and analyzed to determine the most appropriate basis for making disaggregate trip rate comparisons between regions. Trip rates are also tabulated for the Delaware Valley Regional Planning Commission counties and the remainder of southern New Jersey to facilitate comparisons of trip-making characteristics between these geographic areas. Finally, comparisons between the trip-making characteristics of southern and northern New Jersey residents are made.

The almost universal availability of the automobile has done much to standardize aggregate trip generation rates, although considerable variation in individual household rates still exists. Widely used traffic analysis methods such as the Institute of Transportation Engineers (ITE) *Trip Generation Manual* implicitly assume the interregional transferability of trip generation rates because individual observations of trip making made throughout the United States are averaged and analyzed in cross section (1).

The geographic stability of trip generation rates is a major factor in determining data collection strategies. Expensive home interview trip diaries need be collected only in specific geographic areas if the resulting trip rates will be different from those of other areas already surveyed. Of course, trip generation rates are not the only factor influencing the need for transportation data collection. Transit usage and modal split factors may also vary significantly between study areas, especially if the density and scale development and the type and amount of public transit service also differ. However, the adequate estimation of trip generation rates is a major

factor influencing data collection decisions, particularly in regions in which public transportation ridership is relatively insignificant.

In the fall of 1986, the New Jersey Department of Transportation (NJ DOT), through a consultant, conducted a statewide small sample telephone home interview survey. This survey was divided into two independent parts—northern New Jersey and southern New Jersey—each consisting of about 1,400 household interviews (see Figure 1). Because the NJ DOT contract with the consultant did not include tabulation or analysis of the results of the southern survey, Delaware Valley Regional Planning Commission (DVRPC) staff was requested to undertake the activities, for both the New Jersey counties within the DVRPC region and the remaining southern New Jersey counties.

The three tabulations of these rates provide valuable insight into the geographic stability of trip generation rates, because these areas differ significantly in character. Northern New Jersey is part of the New York metropolitan region, with large areas of intensive commercial and residential development. The cities of Newark, Jersey City, and New Brunswick and their suburbs are prime examples of this development. The DVRPC counties are also urban and suburban in character, centered on the cities of Camden and Trenton but with less intensive development patterns than in the north. The remainder of South Jersey is mostly rural in character with smaller cities such as Atlantic City and Vineland.

This paper summarizes the results of the comparative trip generation rate analysis for the New Jersey surveys. Stratification schemes based on family size, income, automobile ownership, and area type (DVRPC region only) are tabulated and analyzed to determine the impact of these input variables on trip making and to identify the most appropriate basis for making disaggregate trip rate comparisons between regions. Trip rates are tabulated for the DVRPC counties and the remainder of southern New Jersey to facilitate comparisons of trip-making characteristics between these geographic areas. Finally, comparisons between the trip-making characteristics found in the southern and northern New Jersey surveys are made.

SURVEY DATA AND STATISTICAL ANALYSIS METHODS

The southern New Jersey survey consisted of 1,413 telephone household interviews taken on Monday through Friday from

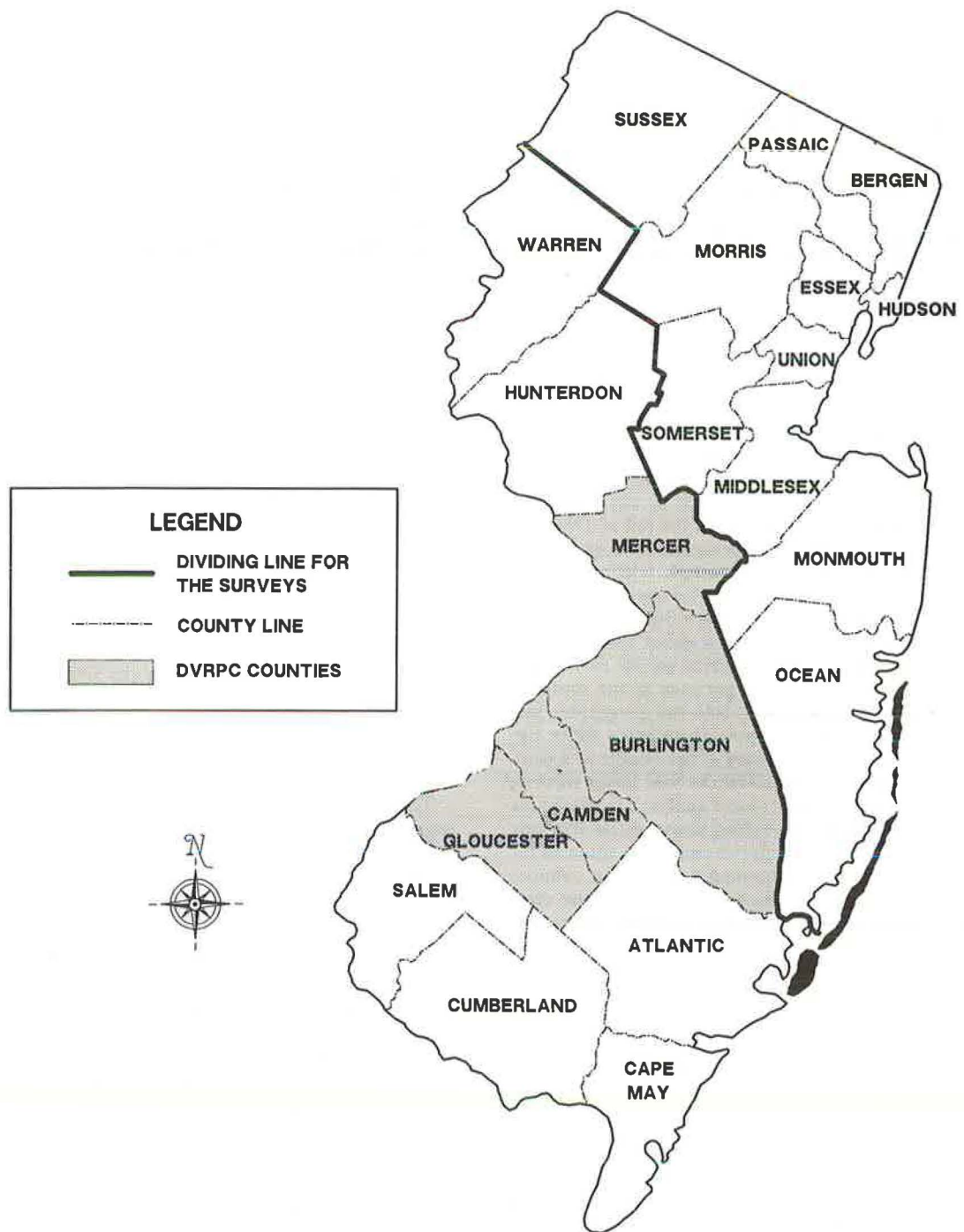


FIGURE 1 Counties included in the southern and northern New Jersey home interview surveys.

October 17 to November 25, 1987. These 1,413 households generated 11,087 weekday trips by all modes, for an average of 7.83 trips per household. Of these 1,413 households, 159 (11 percent) refused to answer the household income question and had to be dropped from the income tabulations. This reduced sample resulted in an overall rate of 8.03 trips per household, about 2.6 percent higher than that for the entire sample. This difference is not statistically significant, however. Rates stratified by automobile ownership and house-

holds are based on the 1,413 household sample, and rates for income strata are based on the smaller sample.

The tabulations of trip rates for the northern and southern New Jersey home interview surveys were accomplished by processing the trip data contained in the survey household files. These files contain household-level totals of trip production by purpose as well as the socioeconomic indicators used to allocate the household to a given cell in the cross-classification matrix. In all of the tabulations, rates are reflec-

tive of total travel (internal/internal + internal/external). These total trip generation rates are useful in travel simulation and project analyses.

For purposes of trip rate analyses and comparisons, three groupings of the southern New Jersey data were prepared:

1. the entire southern New Jersey study area;
2. the DVRPC region; and
3. the remainder of southern New Jersey.

The first grouping is useful for overall rate tabulations and for comparisons with rates calculated for northern New Jersey. The tabulations for the DVRPC region and the remainder of southern New Jersey are used to compare trip generation rates within the DVRPC counties with those outside the region. Because area type is defined at the census-tract level, tabulations involving area type are confined to the DVRPC region where DVRPC staff have geocoded the trip end addresses to tracts. Outside the DVRPC region only consultant-supplied Minor Civil Division codes are available.

The methodology of trip-generation-rate analysis implicit in the southern New Jersey home interview survey is usually termed the "cross-classification" method. This method is similar to the widely used multiple regression technique in that changes in trip rates are measured when changes in two or more dependent variables are accounted for. In this case, however, an n -dimensional matrix of mean or average trip rates is calculated in which each variable (trip purpose, automobile ownership, income, etc.) has at least two subcategories defined by contiguous ranges of the appropriate variable. Cross-classification analysis is disaggregate in that rates are tabulated directly from household data rather than relying on zonal averages of trip rates or independent variables. The use of this technique makes the results comparable with the northern New Jersey trip generation tabulations prepared by the consultant (2).

Three statistical indicators are calculated for each trip rate cell in the cross-classification matrix: the mean or average trip rate for households within that stratum; the number of observations; and the cell standard deviation. The primary output is the cell mean trip rate. The number of observations in the cell and its standard deviation provide statistical measures of the accuracy of the rate (via confidence interval) and facilitate hypothesis tests regarding the difference between rates in selected strata or geographic areas. The confidence interval about the mean trip rate is as follows:

$$\bar{X} \pm \frac{s}{(n)^{1/2}} \cdot t_{\alpha/2, n-1}$$

where

\bar{X} = mean trip rate for cell,

s = cell standard deviation,

n = number of observations, and

$t_{\alpha/2, n-1}$ = t -test statistic (1.960 for 31 or more observations; 12.706 to 2.045 for 2 to 30 observations).

This formula clearly indicates that rate estimation becomes more accurate as the number of observations in the cell increases and decreases as the cell standard deviation grows larger. The t -test regarding the statistical significance of differences between

two mean trip rates is based on the idea that the hypothesis that trip rates differ must be rejected if their confidence intervals overlap. This leads to the two major statistical objectives in evaluating alternative cross-classification schemes: minimize the standard deviation and maximize the number of observations per cell (at least 30 for practical purposes).

Although more nebulous and difficult to define, rate differences may also be categorized in terms of planning significance. Planning significance is related to the magnitude of the difference more than its statistical significance. For this reason, selected tables also contain estimates of difference and percent difference so that any logical patterns of these differences may be identified. A difference of 1 percent may be statistically significant if the sample is large enough and the mean is tightly constrained by the cell standard deviation. This difference is of little planning significance, however.

On the other hand, a difference of 30 percent is of great planning significance even if not statistically significant, provided that the overall rate patterns are logical and on that basis accepted into the trip generation model. A travel difference of 30 percent may significantly change the design of a proposed facility or even its functional class. We somewhat arbitrarily define a difference of 10 percent or more as being of planning significance, particularly if this difference is part of a logical overall pattern of trip rate variation.

ANALYSIS OF SOUTHERN NEW JERSEY STUDY AREA TRIP PRODUCTION RATES

In general, different demographic distributions of households within alternate geographically defined survey areas may cause average overall trip rates to differ. For this reason, it is desirable to make disaggregate comparisons of trip rates based on demographic variables known to be associated with differences in household trip making. On the basis of past experience in travel forecasting at the regional level and the work of other researchers (3-6), the following variables were analyzed as candidate bases for detailed comparison of trip rates:

1. Household size (persons per household),
2. Automobile availability,
3. Household income, and
4. Trip purpose.

Household size is defined as the number of persons occupying a housing unit regardless of the relationship to the householder. Automobile availability is defined as the number of passenger cars available at home for the use of the members of the household. The term "automobile" includes station wagons, vans, and pickups but excludes larger trucks. Income is defined as money received from wages and salaries; nonfarm self-employment; interest, dividends, and net rental; Social Security; public assistance; and all other sources. Trip purpose defines the principal reason for making the trip.

Table 1 presents a percentage breakdown of travel by trip purpose for the southern New Jersey survey. Home-based travel (home-based work, home-based nonwork, and home-based school) together account for 79 percent of total travel generated by residential land uses. As in the northern New Jersey tabulations, home-based nonwork travel excludes school

TABLE 1 SOUTHERN NEW JERSEY SURVEY: PERCENT OF TOTAL TRIPS BY PURPOSE

Trip Purpose	Percent of Total Travel
Home Based Work	27.3%
Home Based Non-Work (excluding school)	40.6%
Home Based Shopping	12.1%
Home Based Social Recreational	8.6%
Home Based Personal Business	10.5%
Home Based Eat Meal	3.6%
Home Based Other	5.8%
Home Based School	11.1%
Non-Home Based	21.0%

	100.0%

TABLE 2 SOUTHERN NEW JERSEY SURVEY: TRIP PRODUCTION RATES BY TRIP PURPOSE AND HOUSEHOLD SIZE

Purpose	Household Size						All Households
	1	2	3	4	5	6	
TOTAL	3.13	6.19	8.07	10.74	12.59	17.26	8.03
THB	2.23	4.55	6.51	8.78	10.45	13.86	6.34
HEWRK	0.75	1.76	2.58	2.79	3.13	3.79	2.18
HENWRK	1.41	2.67	3.24	4.40	4.68	7.21	3.29
HBSCH	0.06	0.12	0.69	1.59	2.64	2.86	0.87
NHB	0.90	1.65	1.56	1.96	2.14	3.40	1.69

Abbreviations:

TOTAL: Total Productions

THB: Total Home Based Productions

HEWRK: Home Based Work Productions

HENWRK: Home Based Productions Excluding Work and School Productions

HBSCH: Home Based School Productions

NHB: Non-Home Based Productions

trips. Commuting travel to and from work accounts for more than 27 percent of travel. Of the home-based nonwork sub-purposes, shopping contributes the most trip making (12.1 percent) followed by personal business (10.5 percent), social-recreational (8.6 percent), and eating meals (3.6 percent). All other home-based nonwork nonschool travel accounts for 5.8 percent of total travel. School travel constitutes 11.1 percent of trips generated, and non-home-based travel generates the remaining 21 percent measured in the home interview survey. Overall, these proportions of travel appear to be reasonable.

Average trip rates stratified by purpose and family size are shown in Table 2. Trips per household for all of southern New Jersey, when stratified by family size, range from 3.13 for a household with one person to 17.26 average weekday trips for households with six or more persons. Household trip rates for individual purposes also increase smoothly with household size. Home-based nonwork trip rates sustain the largest absolute increase, with household size increasing by almost six trips per household. Home-based school has the fastest rate of increase, increasing almost 50-fold over the

TABLE 3 SOUTHERN NEW JERSEY SURVEY: TRIP PRODUCTION RATES BY TRIP PURPOSE AND INCOME

Purpose	Household Income Code									All Households
	0	1	2	3	4	5	6	7	8	
TOTAL	3.20	5.21	5.39	7.58	8.66	9.63	10.48	10.75	10.23	8.03
T H B	2.53	4.15	4.25	6.26	6.94	7.57	7.85	8.22	7.88	6.34
HEWRK	0.29	0.96	1.39	2.04	2.48	2.70	3.24	2.97	2.92	2.18
HENWRK	1.89	2.66	2.21	3.27	3.48	4.04	3.72	3.93	3.81	3.29
HBSCH	0.35	0.53	0.65	0.95	0.98	0.84	0.89	1.32	1.15	0.87
N H B	0.67	1.07	1.14	1.33	1.71	2.06	2.63	2.54	2.35	1.69

Definition of Income Ranges:

Income Code	Definition	Income Code	Definition	Income Code	Definition	Income Code	Definition
0	Under \$10,000						
1	\$10,000 - \$14,999	3	\$20,000 - \$29,999	5	\$40,000 - \$49,999	7	\$60,000 - \$69,999
2	\$15,000 - \$19,999	4	\$30,000 - \$39,999	6	\$50,000 - \$59,999	8	\$70,000 and over

TABLE 4 SOUTHERN NEW JERSEY SURVEY: TRIP PRODUCTION RATES BY TRIP PURPOSE AND AUTOMOBILE AVAILABILITY

Purpose	Autos Available Per Household						All Households
	0	1	2	3	4	5+	
TOTAL	3.23	5.34	8.74	10.16	11.12	15.04	7.81
T H B	2.87	4.16	6.82	8.13	9.35	12.22	6.17
HEWRK	0.68	1.27	2.28	3.18	4.30	5.04	2.14
HENWRK	1.66	2.38	3.50	3.94	3.84	5.91	3.18
HBSCH	0.49	0.52	1.04	1.01	1.21	1.26	0.85
N H B	0.41	1.18	1.92	2.03	1.77	2.83	1.64

range of household sizes. Home-based work and home-based nonwork trip rates also have strong tendencies to increase with household size, with work trips increasing slightly faster than non-home-based trips. Clearly, there is a strong tendency for travel of all types to increase with household size.

The trip rates resulting from preparing similar tabulations stratified by income code are shown in Table 3. Overall, daily trip rates range from 3.20 trips per household for income code 0 (under \$10,000) to 10.23 for income code 8 (\$70,000 and over). Like the stratification by family size discussed above, trip rates tend to increase in a regular fashion with income, increasing both in total and by trip purpose. However, Table 3 clearly indicates a slower rate of growth in the trip rates as income increases, because incomes vary significantly among individuals. A one-person household and a four-person household may both have an income of \$50,000, but the four-person household makes more trips.

Similar tabulations of trip rates stratified by automobile ownership and trip purpose are given in Table 4. Household trip rates increase by automobile ownership as well. The highest total rate of 15.04 (for 5+ car households) is about 4.5 times the rate for 0-car households (3.23). This places the substratum variation in rates for automobile availability between those observed for household size and for income.

STATISTICAL SIGNIFICANCE OF RATE DIFFERENCES BETWEEN NEIGHBORING CROSS-CLASSIFICATION CELLS

Another method for determining the significance of trip rate differences between substrata is to analyze *t*-statistics based on the rate differences between neighboring cells. Table 5 presents the results of this analysis by major trip purpose for

TABLE 5 *t*-TEST FOR STATISTICAL SIGNIFICANCE OF RATE DIFFERENCES BETWEEN NEIGHBORING CELLS

Trip Purpose	Persons Per Household				
	1	2	3	4	5
	v.s 2	v.s 3	v.s 4	v.s 5	v.s 6-9
Total Trips	12.38	5.21	5.56	3.02	2.84
Home Based Work	9.73	6.17	1.27	1.51	1.35
Home Based Non-work	7.24	2.32	3.53	0.69	2.33
Home Based School	1.72	7.77	6.84	4.54	0.48
Non-Home Based	5.19	0.52	1.96	0.63	2.02

Trip Purpose	Household Income (thousands of dollars)							
	1-10	10-15	15-20	20-30	30-40	40-50	50-60	60-70
	v.s 10-15	v.s 15-20	v.s 20-30	v.s 30-40	v.s 40-50	v.s 50-60	v.s 60-70	v.s 70 & Over
Total Trips	3.85	0.21	4.61	1.71	1.28	0.47	0.53	0.49
Home Based Work	4.01	2.09	3.83	2.98	1.25	2.20	0.88	0.16
Home Based Non-Work	2.13	1.14	3.12	0.67	1.47	0.69	0.37	0.21
Home Based School	0.94	0.57	1.73	0.20	0.88	0.28	1.63	0.60
Non Home Based	1.93	0.31	0.96	2.03	1.41	1.66	0.23	0.51

Trip Purpose	Auto Availability Per Household				
	0 Car	1 Car	2 Car	3 Car	4 Car
	v.s 1 Car	v.s 2 Car	v.s 3 Car	v.s 4 Car	v.s 5 Car
Total Trips	4.21	10.94	2.95	1.50	1.86
Home Based Work	3.15	11.04	6.13	2.99	1.01
Home Based Non-Work	2.62	5.80	1.42	0.11	1.53
Home Based School	0.16	5.78	0.37	0.69	0.18
Non-Home Based	5.51	5.74	0.53	0.61	1.42

household size, income, and automobile ownership. For instance, in Table 5 the *t*-statistic associated with the rate difference in total travel between one- and two-person households is 12.38, and the corresponding value between two- and three-person households is 5.21. Since all cells in Table 5 are based on more than 30 degrees of freedom, the threshold value at 95 percent confidence is 1.96. On this basis, all household size categories have a significantly different rate for total travel. This rate does not apply for work travel, however, where households with three or more persons do not have rates that are statistically significantly different from those in the previous strata. On this basis, three categories of work-trip-related household sizes may be defined as one person, two persons, and three or more persons. However, home-based nonwork and home-based school travel tend to increase significantly in trip rates throughout the range of household sizes. Non-home-based travel tends to separate into three

ranges: one- and two-person, three- and four-person, and 5+-person households.

Of the three variables considered, the stratification by income presents the most opportunities to collapse strata, because there is a strong tendency for growth in trip rates to level off and lack statistical significance among the higher income strata (see Table 5). Except for work travel, no income stratum above \$40,000 has a trip rate significantly different from that in the next lower income stratum. These higher-income groups tend to be a composite of a wide range of family sizes whose aggregate trip rates may change in response to changes in income levels and the workforce participation rate among women and children. Cross-classification by income and family size will reduce the impact of these factors on rate instability but result in an increase in the number of trip rates to be considered.

Automobile availability categories 3, 4, and 5+ may be

TABLE 6 COMPARISON OF DELAWARE VALLEY TRIP RATES WITH THOSE FOR
REMAINDER OF SOUTHERN NEW JERSEY AREA

Study Area	Persons Per Household						All Households
	1	2	3	4	5	6-9	
Total Trips Per Household							
DVRPC Region	3.24	6.30	8.03	10.80	12.31	17.17	8.11
Rest of S. Jersey	2.96	6.02	8.12	10.59	12.95	17.50	7.91
Difference	0.28	0.28	-0.09	0.21	-0.64	-0.33	0.20
Percent Difference	8.6%	4.4%	-1.1%	1.9%	-5.2%	-1.9%	2.5%
"t" Test Statistic	0.77	0.74	-0.14	0.27	-0.65	-0.09	0.59
Home Based Work Trips per Household							
DVRPC Region	0.82	1.89	2.712	2.76	3.25	3.70	2.27
Rest of S. Jersey	0.64	1.54	2.37	2.83	2.98	4.00	2.03
Difference	0.18	0.35	0.34	-0.07	0.27	-0.30	0.24
Percent Differ.	22.0%	18.5%	12.5%	-2.5%	8.3%	-8.1%	10.6%
"t" Test Statistic	1.23	2.25*	1.51	-0.26	0.71	-0.30	2.17*
Home Based Non-Work Trip per Household (Non-School)							
DVRPC Region	1.40	2.66	3.06	4.67	4.65	7.10	3.33
Rest of S. Jersey	1.43	2.68	3.52	3.85	4.72	7.50	3.23
Difference	-0.03	-0.02	-0.46	0.82	-0.07	-0.40	0.10
Percent Differ.	-2.1%	-0.75%	-15.0%	17.6%	-1.51%	-5.63%	3.00%
"t" Test Statistic	-0.12	-0.08	-1.06	1.53	0.11	-0.17	0.49
Home Based School Trips per Household							
DVRPC Region	0.11	0.13	0.65	1.48	2.81	2.83	0.86
Rest of S. Jersey	0.00	0.11	0.76	1.82	2.42	2.92	0.87
Difference	-0.04	-0.02	-0.11	-0.34	0.39	-0.09	0.01
Percent Differ.	100.0%	15.4%	-16.9%	-23.0%	13.9%	-3.2%	-1.2%
"t" Test Statistic	2.07*	0.41	-0.77	-1.43	0.96	-0.10	-0.11
Non-Home Based Trips per Household							
DVRPC Region	0.90	1.62	1.61	1.90	1.59	3.53	1.64
Rest of S. Jersey	0.89	1.69	1.47	2.09	2.83	3.08	1.77
Difference	0.01	-0.07	0.14	-0.19	-1.24	0.45	-0.13
Percent Differ.	1.11%	-4.3%	8.7%	-10.0%	-78.0%	12.8%	-7.9%
"t" Test Statistic	0.05	-0.32	0.50	-0.59	-2.63*	0.35	-0.98

* Indicates Statistically Significant Difference

aggregated into a single 3+ category because the rate difference between these categories, although logical, is not statistically significant except for work travel. Furthermore, the 4 and 5+ automobile categories of households together constitute only 5.7 percent of the sample.

For purposes of comparing trip rates by geographic area, trip purpose and household size were selected as the most appropriate bases for comparison. Trip purpose was selected because of the theoretical importance placed on this variable in most trip generation analyses. Furthermore, trip rates vary significantly by purpose. Household size was selected over income and automobile ownership as the second basis for comparison because trip rates vary significantly across the range of household sizes for all trip purposes except for work and because this variable had the most uniform distribution of home interview surveys to individual subcategories.

COMPARISON OF TRIP RATES BY GEOGRAPHIC AREA

The 1986 home interview survey was unique in that it covered the entire state of New Jersey in two separate surveys. For this reason, it is possible to test the statistical significance of differences between trip rates calculated for the DVRPC counties and the remainder of the southern New Jersey study area and between northern and southern New Jersey.

Southern New Jersey and DVRPC Counties

Table 6 presents a comparison of trip rates stratified by trip purpose and family size between the DVRPC counties (Mercer, Burlington, Camden, and Gloucester) and the remaining counties in the southern New Jersey study area (Atlantic, Cape May, Cumberland, Hunterdon, Salem, and Warren). Table 6 contains the trip rate for each geographical area together with the *t*-test statistic that measures the degree of statistical significance to be attached to the difference and percent difference, also shown. Since all cells in Table 6 have 30 or more degrees of freedom (40 to 408), the *t*-statistic must have a value of 1.96 or greater for the difference between the trip rates to be statistically significant with a 95 percent confidence level.

The *t*-test statistics clearly show that trip rates for the DVRPC

counties and the rest of southern New Jersey are for the most part statistically equivalent. Only 4 of the 35 trip rates in this table have significant differences, and these differences tend to be scattered throughout the table and do not appear indicative of a clear pattern.

No trip rate for total travel was found to be statistically different either when stratified by household or in total. The highest *t*-value for the total trip purpose was 0.77, which does not even approach the value needed for statistical significance (1.96). Two rates for home-based-work travel were statistically different: the rate for two-person households and for total work travel. The work trip rates for the DVRPC region were 18 percent higher for two-person households and 10 percent higher for all households (about 0.2 trip per household per day). The rate for school trips for one-person households in the DVRPC region was significantly higher because of an obvious deficiency in the data for the remainder of southern New Jersey (no observed travel). The rate differences for two-, three-, four-, and five-person households, although large in absolute terms (14 to 25 percent), lack the rational pattern required for planning importance and are of no statistical significance. Similarly, the non-home-based rate for the DVRPC region was significantly lower for five-person households but irrational in pattern because the five-person rate was lower than the four-person rate.

In summary, the principal difference between trip rates for the DVRPC counties and the rest of southern New Jersey is in work trips. DVRPC counties have a higher rate for four out of six household strata. These rates probably resulted from the higher labor participation rate in the DVRPC counties—1.25 employed residents per household versus 1.16 employed residents per household in the remainder of the study area. Table 7 contains a comparison of home-based-work rates based on employed residents per household for the DVRPC counties versus the rest of southern New Jersey. When stratified in this manner, the statistical significance of the rate difference disappears. It is interesting to note that the corresponding value from the 1980 census was about 1.54. The reasons for the difference may involve seasonal variations in second jobs (Christmas-related in the New Jersey survey) and the fact that external-local work trips were excluded from the census tabulation. In addition, 1.54 represents a weighted average for the entire Delaware Valley Region. The relatively small sample from urban areas in the New Jersey survey may have underrepresented these areas in the average.

TABLE 7 HOME-BASED WORK TRIP RATE COMPARISONS BY EMPLOYED RESIDENTS PER HOUSEHOLD

Study Area	Employed Residents/Household			
	1	2	3	4
DVRPC Region	1.79	3.59	5.27	7.07
Rest of S. Jersey	1.74	3.47	4.97	7.80
Difference	0.05	0.12	0.30	-0.73
Percent Difference	2.8%	3.3%	5.7%	-10.3%
"t" Test Statistic	0.74	1.17	1.00	-0.90

TABLE 8 COMPARISON OF SOUTHERN AND NORTHERN NEW JERSEY HOME INTERVIEW SURVEY TRIP RATES

Study Area	Persons Per Household						All Households
	1	2	3	4	5	6-9	
Total Trips per Household							
Southern Jersey	3.13	6.19	8.07	10.74	12.59	17.26	8.03
Northern Jersey	3.17	6.33	7.91	10.62	12.19	17.47	7.85
Difference	-0.04	-0.14	0.16	0.12	0.40	-0.21	0.18
% Difference	-1.3%	-2.3%	2.0%	1.1%	3.2%	-1.2%	2.2%
"t" Test Statistic	-.17	-.51	.39	.23	.51	-.10	.78
Home Based Work Trips Per Household							
Southern Jersey	0.75	1.76	2.58	2.79	3.13	3.79	2.18
Northern Jersey	0.76	1.80	2.66	3.13	3.10	4.59	2.27
Difference	-0.01	-0.04	-0.08	-0.34	0.03	-0.80	0.09
% Difference	-1.3%	-2.3%	-3.1%	-12.2%	1.0%	-21.1%	4.1%
"t" Test Statistic	-.01	-.37	-.54	-1.98*	.11	-1.38	1.20
Home Based Non-Work Trips per Household (non-school)							
Southern Jersey	1.41	2.67	3.24	4.40	4.68	7.21	3.29
Northern Jersey	1.37	2.68	2.91	3.69	4.78	6.51	3.01
Difference	0.04	-0.01	0.33	0.71	-0.10	0.70	0.28
% Difference	2.8%	-0.4%	10.2%	16.1%	-2.1%	9.7%	8.5%
"t" Test Statistic	0.25	0.05	1.22	2.13*	0.20	0.56	2.12*
Home Based School Trips per Household							
Southern Jersey	0.06	0.12	0.69	1.59	2.64	2.86	0.87
Northern Jersey	0.03	0.13	0.55	1.52	2.24	2.88	0.74
Difference	0.03	-0.01	0.14	.07	0.40	-0.02	0.13
% Difference	50.0%	-8.3%	20.3%	4.4%	15.2%	-0.7%	14.9%
"t" Test Statistic	1.03	-.29	1.48	.45	1.35	-.04	2.13*
Non-Home Based Trips Per Household							
Southern Jersey	0.90	1.65	1.56	1.96	2.14	3.40	1.69
Northern Jersey	1.00	1.72	1.80	2.27	2.06	3.49	1.82
Difference	-0.10	-0.07	-0.24	-0.31	-0.49	-0.09	-0.13
% Difference	-11.1%	-4.2%	-15.4%	-15.8%	-22.9%	-2.6%	-7.7%
"t" Test Statistic	-.75	-.45	-1.24	-1.38	-1.34	-.12	-1.41

* Indicates Statistically Significant Difference

TABLE 9 VARIATION OF HOUSEHOLD TRIP RATES BY TRIP PURPOSE AND AREA TYPE FOR DVRPC REGION

Trip Purpose	Area Type				All Households
	Urban	Suburban	Rural	Open Rural	
HEW	2.17	2.25	2.30	2.30	2.25
HENW	2.72	3.24	3.13	3.70	3.17
HBSCH	0.57	0.76	1.26	0.78	0.85
NHB	1.66	1.56	1.55	1.83	1.57
TOTAL	7.13	7.82	8.24	8.61	7.84

Southern Versus Northern New Jersey

Trip rates similar to those described above were tabulated for the northern New Jersey study area by the consultant and presented in a report (2). The northern New Jersey data were collected by the same consultant using identical sampling and telephone interview techniques. Table 8 compares trip rates by purpose and family size from the southern New Jersey survey with the corresponding value from the northern New Jersey home interview survey. The cutoff value for statistical significance here is 1.96 as well, because the degrees of freedom in the *t*-statistic range from 99 to 808.

Overall, these comparisons (Table 8) show very little difference in trip rates between the surveys. Only four cell values were significantly different. Total trip rates were virtually identical. In aggregate, work trip rates were 4 percent higher in the northern survey, particularly for 4- and 6+-person households (12 and 21 percent, respectively). Home-based nonwork and home-based school production rates were generally higher (8.5 percent and 14.9 percent, respectively) in the southern survey, and non-home-based rates were 7.7 percent higher in the northern survey. However, these comparisons are generally lacking in statistical significance. Only the four-person households for home-based work and nonwork and overall rates for home-based nonwork and school trips were statistically different.

Although these statistical comparisons indicate that few significant differences in trip rates occur between the northern and southern study areas and between the DVRPC counties and the remainder of southern New Jersey, geographic variations in trip rates occur within each study area. The study areas considered are large diverse heterogeneous mixtures of land uses, including numerous urban, suburban, and rural areas. Because of this, the trip rates analyzed are averaged over diverse land uses and area types, which may mask significant geographical variations in trip-making patterns within each study area.

For instance, area type was available as a basis for stratification within the DVRPC counties, and the resulting trip rates are shown in Table 9. Although lacking in statistical significance because of small sample sizes in urban areas, this pattern of trip rates clearly shows a logical increase in trip rate as the density of development declines for home-based work, nonwork, and total travel. This is thought to occur because walk travel is omitted from the trip diaries except for work trips. The long distances associated with rural travel

make walking less feasible. There is no consistent pattern for home-based school or non-home-based trips by area type. Other researchers have observed significant differences between urban and rural trip rates (6-8).

CONCLUSIONS

Little difference in terms of trip rates was found between the DVRPC counties and the rest of southern New Jersey or between the northern and southern New Jersey study areas. Size-based rates were statistically significantly different between the DVRPC counties and the rest of southern New Jersey in only 4 of 35 households. The principal difference from a planning perspective is related to work trips, which usually had a higher rate per household in the DVRPC region (10 percent higher in total). This difference, which may have resulted from the higher labor participation rate in the DVRPC counties, disappears when work trip rates are stratified by employed residents per household.

The principal differences in trip rates between the northern and southern New Jersey surveys were in home-based nonwork, school, and non-home-based travel. Residents in the southern study area more frequently made home-based nonwork (8 percent) and school trips (15 percent), whereas northern New Jersey residents made 8 percent more non-home-based trips. In total, both work and nonwork trip rates showed no statistically significant variation between the northern and southern study areas.

However, this result should be qualified by the small sample sizes and the large heterogeneous nature of the study areas considered. There is some evidence within the DVRPC counties that trip rates vary significantly by area type, with urban rates being lower than suburban and rural rates. This variation results from the higher tendency to make walk trips in large urban areas. The small sample associated with urban land uses made it difficult to draw strong statistical conclusions in this regard, however.

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