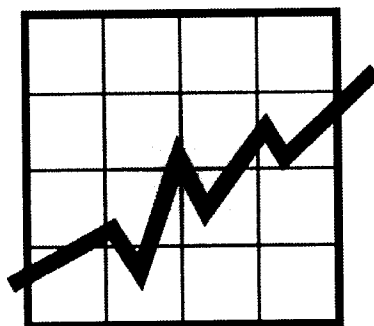


EAST-WEST GATEWAY COORDINATING COUNCIL

HOUSEHOLD TRAVEL SURVEY

Final Report of Survey Results

January 31, 2003



NuStats

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The **East-West Gateway Coordinating Council** is the Metropolitan Planning Organization for the **St. Louis Metropolitan Area**. The Council is led by a Board of Directors comprised of locally elected officials and regional leaders, which meets at 10:00 a.m. on the last Wednesday of every month. The work of the Council is carried out by an Executive Director and a staff organized into four departments: Administration, Transportation Planning, Planning & Information Services, and Policy & Programming. The work of the Council is also influenced by a number of Advisory Committees made up of community leaders from both the public and private sectors.

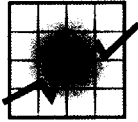
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The contents of this report reflect the views of the author who is responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the local, state, and federal governmental agencies mentioned above. This report does not constitute a standard, specification, or regulation.



TABLE OF CONTENTS

Executive Summary	1
Background	1
Survey Objective	1
Pilot Tests	1
Survey Methodology	2
Key Findings	4
Travel and Activity Patterns	9
Mode of Travel	9
Time of Travel	12
Purpose for Travel	20
Trip Duration	22
Specialized Travel: Work and Peak Period	25
Travel for Work	25
Peak Period Travel	30
Household Characteristics and Travel	32
Volume of Trips	32
Household Composition and Trip-Making	33
Socio-Economic Status and Trip-Making	34
Person Characteristics and Travel	36
Demographic Characteristics	36
School Attendees	37
Employment	38
GPS Survey Results	41
Deployment Results	41
Trip Comparison Results	43
Trip Correction Factors and Application: Next Steps	44



LIST OF TABLES

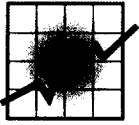
Table 1: Sample Goals and Outcomes	2
Table 2: Statistical Reliability of County Samples	4
Table 3: Key Household Statistics (Expanded) for the St. Louis Region	5
Table 4: Key Household Statistics (Expanded) by County of Residence	5
Table 5: Key Trip Statistics (Expanded) for the St. Louis Region	6
Table 6: Key Trip Statistics (Expanded) by County of Residence	6
Table 7: Comparative Metro Area Statistics	8
Table 8: Person Trip Origins and Destinations by County	9
Table 9: Detailed Trip Purposes	20
Table 10: AM Peak Trip Origins and Destinations by County	30
Table 11: PM Peak Trip Origins and Destinations by County	30
Table 12: Households and Trips by Household Location	32
Table 13: Households and Trips by Household Size	33
Table 14: Households and Trips by Number of Workers	33
Table 15: Households and Trips by Presence of Children	34
Table 16: Households and Trips by Household Income	34
Table 17: Households and Trips by Vehicle Ownership	35
Figure 34: Vehicle Body Types	35
Table 18: Persons and Trips by Age	36
Table 19: Persons and Trips by Gender	36
Table 20: Persons and Trips by Employment Status	39
Table 21: Completion Breakdown of Deployed GPS Households	42
Table 22: Summary of Trip Comparisons by County	44
Table 23: Trip Comparison by Number of Vehicles	45



LIST OF FIGURES

Figure 1: Geographic Distribution of Sampled Households	3
Figure 2: Total Weekday Trips by County within the St. Louis Region	7
Figure 3: Mode of Travel for Daily Person Trips	9
Figure 4: Mode of Travel by County of Home Location	10
Figure 5: Mode of Travel by County of Destination Location	10
Figure 6: Mode of Travel by County of Home Location	11
Figure 7: Trip Distribution by Time of Day	12
Figure 8: Trip Distribution by Trip Departure Hour	12
Figure 9: Trip Distribution by Time of Day by County of Residence	13
Figure 10: Mode of Travel Distribution by Time of Day	13
Figure 11: Time of Travel by Age	14
Figure 12: Destinations for Nighttime Trips (11p.m. to 6 a.m.)	15
Figure 13: Destinations for AM Peak Trips (6 a.m. to 8 a.m.)	16
Figure 14: Destinations for Midday Trips (8 a.m. to 4 p.m.)	17
Figure 15: Destinations for PM Peak Trips (4 p.m. to 7 p.m.) ⁷⁵	18
Figure 16: Destinations for Evening Trips (7 p.m. to 11 p.m.)	19
Figure 17: Summary Trip Purposes	20
Figure 18: Home-Based Trip Purpose by Time of Day	21
Figure 19: Mode of Travel by Home-Based Trip Purpose	22
Figure 20: Distribution of Trip Duration	22
Figure 21: Trip Duration by County of Home Location	23
Figure 22: Trip Duration by Period of Day	23
Figure 23: Trip Duration by Home-Based Trip Purpose	24
Figure 24: Starting Hour For Trips To Work	25
Figure 25: Starting Hour for Trips From Work	26
Figure 26: Geographic Distribution of Work Locations	27
Figure 27: Mode of Work Trip by County of Residence	28
Figure 28: Main Mode of Trip to Work by Gender	28
Figure 29: Main Mode of Trip to Work by Age	29
Figure 30: Main Mode of Trip to Work by Vehicle Ownership	29
Figure 31: Peak Period Trips by Trip Purpose	31
Figure 32: Peak Period Trips by Travel Mode	31
Figure 33: Number of Trips per Household on Assigned Travel Day	32
Figure 34: Distribution of Licensed Drivers	37
Figure 35: Distributions of Persons Enrolled in School by Age	37
Figure 36: Number of Jobs among Employed Persons	38

Figure 37: Status of Unemployed Persons	38
Figure 38: Usual Mode to Main Job	39
Figure 39: Usual Mode to Main Job by County of Residence	40
Figure 40: Example Screen and Map for Perfect Match of GPS-Measured and CATI Reported Trips	46
Figure 41: Example Map and Screen of GPS-Detected and CATI Unreported Trip	47



EXECUTIVE SUMMARY

BACKGROUND

This report presents selected results from the 2002 Household Travel Survey for the St. Louis region. The survey collected weekday travel behavior characteristics from a representative sample of households residing in each of the eight counties that comprise the St. Louis region. Survey methods included both telephone interviews to collect demographic information about persons and households in the region and a travel log that was designed to capture activity and travel information for household members during a 24-hour timeframe. The data will be used to update transportation demand forecasting models and to identify transportation needs in the region. All data collection activities conformed to standard procedures for conducting household travel surveys. The sampling, survey design, and reporting methodologies are recognized by major research organizations, including the Transportation Research Board (TRB), the American Association of Public Opinion Research (AAPOR), and the Council of American Survey Research Organizations (CASRO).

SURVEY OBJECTIVE

The household travel survey objective was to provide socioeconomic and travel behavior data for regional transportation modeling databases. The resulting databases will be used to update and expand regional transportation demand models, including the functions of estimating trip generation and distribution, mode choice, and assignments. In order to achieve the desired results, the household travel survey had the following goals:

- Capture a random sample of households within the St. Louis region.
- Collect demographic data about all persons in households.
- Collect data on vehicles available to households.
- Capture data from trips made by all modes including origin / destination addresses.
- Collect 24-hour activity and trip details for all persons in households.

PILOT TESTS

Two pilot tests were conducted to ensure that the survey design and materials would capture the data necessary to meet the survey objectives. First, focus groups were held to examine factors that affect participation in travel behavior surveys or might hinder accurate completion of the travel log portion. Four focus groups were held, one each with transit users, low-income single parents, double-income parents of children ages 6 to 15, and individuals ages 18-29. Focus group results were used to revise survey materials, interviewer scripts, and other respondent materials prior to the full dress rehearsal of survey procedures.

Subsequent to the focus groups, a full dress rehearsal of survey procedures was conducted. A total of 147 households were recruited to participate in the full pilot, and of these, 97 households completed travel logs for each member of the household. Based on the pilot test results, improvements were made in the recruitment interview script, minor text changes were made to the travel log, and interviewer training targeted frequently "refused" questions (i.e., income and employer information).

SURVEY METHODOLOGY

Survey data collection was conducted in two phases – Spring 2002 and Fall 2002. Beginning in April 2002, households in the St. Louis region were recruited by telephone to participate in the survey, which required every household member to complete a 24-hour travel log.¹ Demographic interviews were conducted with a representative sample of these households to gather data about the household and its members. Following the demographic interviews, households were randomly assigned a travel day on which their members were asked to record travel destination locations, travel mode, trip duration, persons traveling and destination activity. A complete list of survey data items can be found in the Final Report of Survey Methodology. Travel days for Spring 2002 started on April 23 and ended on May 30. Travel Days for Fall 2002 started on September 3 and ended on December 12.

The survey universe was defined as all households with telephones located within the Missouri counties of St. Louis, St. Louis City, Franklin, Jefferson, and St. Charles, and the Illinois counties of Madison, Monroe, and St. Clair. According to data from the U.S. Bureau of the Census, there were 968,533 total households within these counties in 2000. The sample for the household travel survey was drawn from this universe. Within counties, a pure random sample of households with telephones was selected. The sample goals by county were designed to be proportionate to household population (see Table 1).

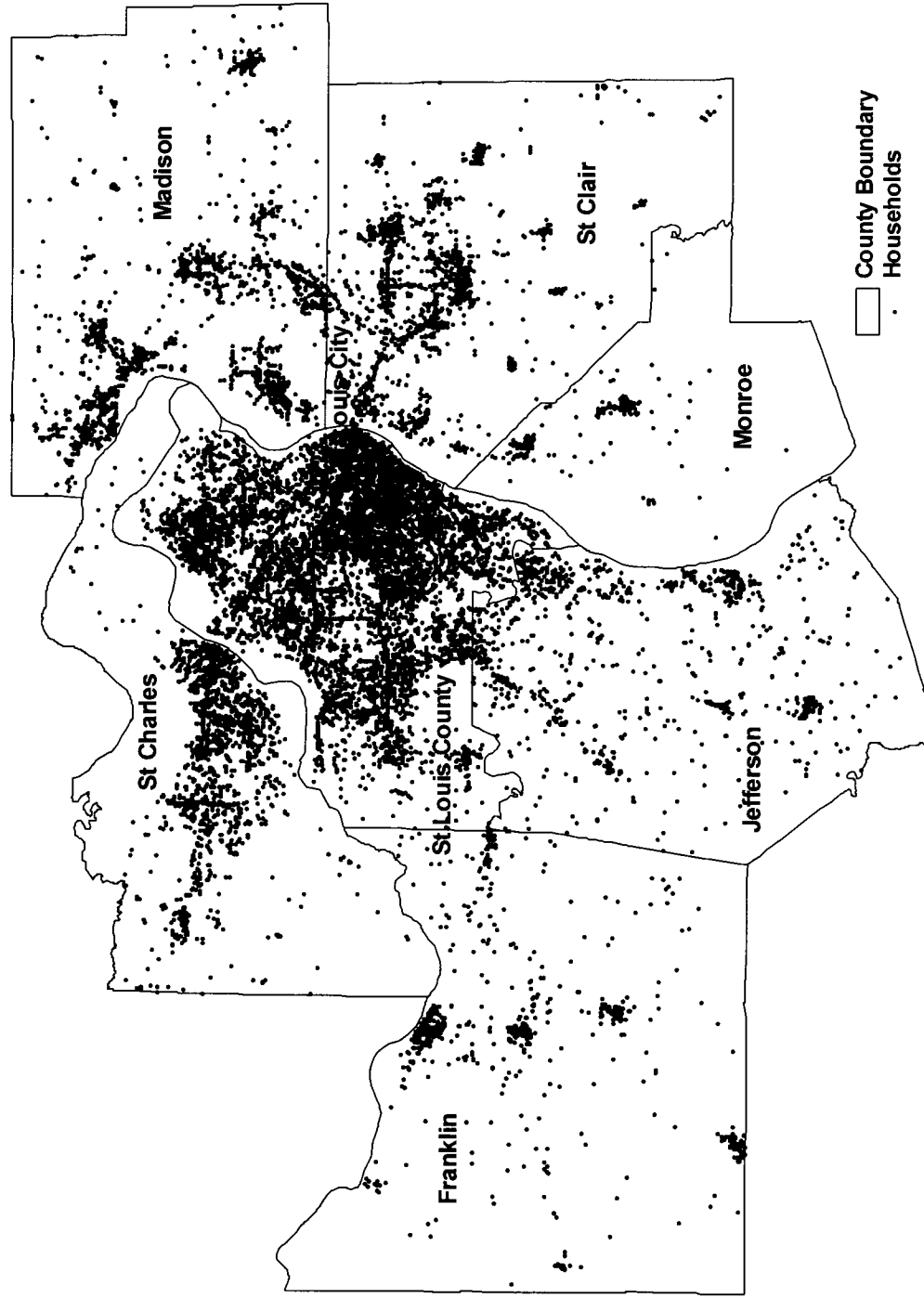
TABLE 1: SAMPLE GOALS AND OUTCOMES

County	Household Population	HH Population %	Sample Goals	Sample Outcomes
St. Louis	404,312	41.7	2,087	2,118
St. Louis City	147,076	15.2	759	745
Madison	101,953	10.5	526	552
St. Charles	101,663	10.5	525	512
St. Clair	96,810	10.0	500	496
Jefferson	71,499	7.4	369	386
Franklin	34,945	3.6	180	214
Monroe	10,275	1.1	54	71
Total	968,533	100.0	5,000	5,094

The final database provides a good geographic representation of households in the study area. Figure 1 (on the next page) illustrates the geographic dispersion of sampled households among eight (8) counties.

¹ Because the rate of non-telephone ownership in the region is so slight (less than 3% of households), it was not necessary to introduce special procedures to capture non-telephone households in the sample.

FIGURE 1: GEOGRAPHIC DISTRIBUTION OF SAMPLED HOUSEHOLDS



Data collected by NuStats
 Coverage data provided by East-West Gateway Council 2002.
 Projection: State Plane NAD 1983 Missouri East

Findings presented in this report are based on aggregated data, totaling 5,094 randomly sampled households. These aggregate data have been weighted to reflect a proportionate distribution of households by county and also balanced by household size and vehicle ownership. The data were expanded to 2000 statistics for total households from the U.S. Bureau of the Census. Thus, the 5,094 sampled households were used to represent all 968,533 households in the study area. (Also see Final Report of Survey Methodology for full disclosure of sampling and data collection methods, sample weight and expansion factor construction, and response rate calculations.)

TABLE 2: STATISTICAL RELIABILITY OF COUNTY SAMPLES

County	Final Sample	Statistical Reliability
St. Louis	2,118	+/- 2 percent
St. Louis City	745	+/- 3 percent
Madison,	552	+/- 3 percent
St. Charles	512	+/- 3 percent
St. Clair	496	+/- 3 percent
Jefferson	386	+/- 3 percent
Franklin	214	+/- 3 percent
Monroe	71	+/- 2 percent

Note: This was calculated at the 95 percent confidence level at the most conservative coefficient of variation to cover all survey data elements.

KEY FINDINGS

The 5,094 households in the survey sample represented 968,533 households and 2,428,730 persons in the St. Louis region. Data from the Census 2000 indicated that the St. Louis region had 968,533 households and 2,482,935 persons. While the expanded data matched total households, it totaled fewer persons due to the slight over-representation of 2-person households and under-representation of 4- and 5-person households in the sample. Because of the weight by household size that was applied to the data, the average household size for the expanded data was 2.51 persons. This estimate closely matched the Census 2000 estimate of 2.56 persons.

Other key household statistics based on the expanded survey data also closely matched Census 2000 estimates. Census data indicated that the mean number of workers per household was 1.23; and the average number of vehicles available to each household was 1.8. For the United States as a whole, household size averaged 2.59 persons; workers per household averaged 1.28; and the average number of vehicles available for households in the United States was 2.0.

TABLE 3: KEY HOUSEHOLD STATISTICS (EXPANDED) FOR THE ST. LOUIS REGION

Variable	St. Louis Region
Total Households	968,533
Total Persons	2,428,730
Persons per HH	2.51
Total Workers	1,173,772
Workers per HH	1.22
Total Vehicles	1,637,553
Vehicles per HH	1.69

Base: 5,059 Households in the St. Louis region, weighted by geography, household size, and vehicle ownership and expanded to represent all households.

Key household statistics varied by county of residence. With most similarity in household demographics observed among households located in Franklin, Jefferson, St. Charles, and Monroe counties. Most dissimilar were households in St. Louis City.

TABLE 4: KEY HOUSEHOLD STATISTICS (EXPANDED) BY COUNTY OF RESIDENCE

Variable	St. Louis County	St. Louis City	Franklin County	Jefferson County	St. Charles County	Madison County	Monroe County	St. Clair County
Total Households	404,312	147,076	34,945	71,499	101,663	101,953	10,275	96,810
Total Persons	992,735	323,210	97,701	203,112	266,978	254,559	26,908	263,528
Persons per HH	2.45	2.20	2.80	2.84	2.63	2.50	2.62	2.72
Total Workers	477,145	140,699	49,713	100,243	142,376	131,740	14,143	117,715
Workers per HH	1.19	0.97	1.43	1.41	1.41	1.30	1.39	1.22
Total Vehicles	676,428	160,872	76,321	141,694	199,480	188,827	22,722	171,211
Vehicles per HH	1.67	1.09	2.18	1.98	1.96	1.85	2.21	1.77
Mean Age of Persons	39.3	37.9	35.3	34.7	35.6	38.9	38.3	35.8

Base: 5,094 Households in the St. Louis region, weighted by geography, household size, and vehicle ownership and expanded to represent all households. Total Persons and Total Workers counts are different from total counts in Table 3 because cell counts have been rounded.

Table 5 summarizes the survey trip characteristics of persons and households residing in the study area. When the 46,909 unlinked trips were expanded to the region, there were nearly 9.5 million person trips generated in the region on an average weekday. For purposes of this reporting, a "trip" was defined as travel from one place to another place. Data were reported for a 24-hour period from 3:00 a.m. to 2:59 a.m. Total trips were based on unlinked trips for all persons.

Of all trips, 88 percent were vehicle trips. Six (6) percent of total trips were non-motorized trips and 2 percent were transit trips.² Most vehicle trips (47 percent) were single occupancy vehicle (SOV) trips.

² Less than one percent of all trips (0.2 percent) were "other" mode. "Other" modes included such categories as airplane, wheelchair, skates.

TABLE 5: KEY TRIP STATISTICS (EXPANDED) FOR THE ST. LOUIS REGION

Variable	St. Louis Region
Total Person Trips ³	9,457,294
Mean Trips per HH	9.76
Mean Trips per Person	3.89
Mean Trip Duration (minutes)	17.87
Mean Work Trip Duration (minutes)	22.57
Total Vehicle Trips ⁴	8,316,427
Total Transit Trips ⁵	150,495
Total School bus Trips	422,319
Total Non-motorized Trips ⁶	553,310

Base: 46,909 unlinked trips weighted by geography, household size, and vehicle ownership and expanded to represent 9,457,294 total daily person trips.

On a per person basis for the region, 3.89 trips were made on an average weekday, and 9.76 trips were generated per household. These regional estimates were lowered due to the trip statistics among households located in St. Louis City, which on both trips-per-person and trips-per-household bases, were much lower than households located in all other counties in the region.

TABLE 6: KEY TRIP STATISTICS (EXPANDED) BY COUNTY OF RESIDENCE

Variable	St. Louis County	St. Louis City	Franklin County	Jefferson County	St. Charles County	Madison County	Monroe County	St. Clair County
Total Person Trips	4,046,689	1,054,276	382,189	746,793	1,074,833	1,025,798	104,903	1,021,812
Mean Trips / HH	10.01	7.17	10.94	10.44	10.57	10.06	10.21	10.55
Mean Trips / Person	4.08	3.26	3.91	3.68	4.03	4.03	3.90	3.88
Mean Trip Duration	17.07	18.50	18.87	20.90	18.76	17.22	17.49	17.54
Mean Work Trip Dur	22.04	19.57	25.28	27.24	24.18	22.63	24.11	21.04
Total Vehicle Trips	3,583,693	802,684	359,770	670,911	970,646	922,671	94,751	911,302
Total Transit Trips	49,560	67,463	0	3,456	5,605	11,431	300	12,681
Total School Bus	157,433	50,197	15,494	53,702	50,403	40,531	4,914	49,645
Total Non-motorized	249,726	131,491	6,183	17,907	45,570	50,438	4,938	47,057

Base: 46,909 unlinked trips weighted by geography, household size, and vehicle ownership and expanded to represent 9,457,294 total daily person trips. Totals may be different from total counts in Table 5 because cell counts have been rounded.

The highest rates of travel in the region were among households located in St. Louis County, Madison County and St. Charles County, where the mean trips per persons were 4.08, 4.03 and 4.03, respectively. Mean travel time in the region for all weekday trips was slightly less than 18 minutes, and for work trips, mean travel time was just less than 23 minutes. The longest work commutes were found for households located in Jefferson County (27 minutes on average) and the shortest were for households in St. Louis City (almost 20 minutes on average). Another way to view the rates of travel by county is in terms of total trips generated. Figure 2 on the following page depicts total weekday trips by county.

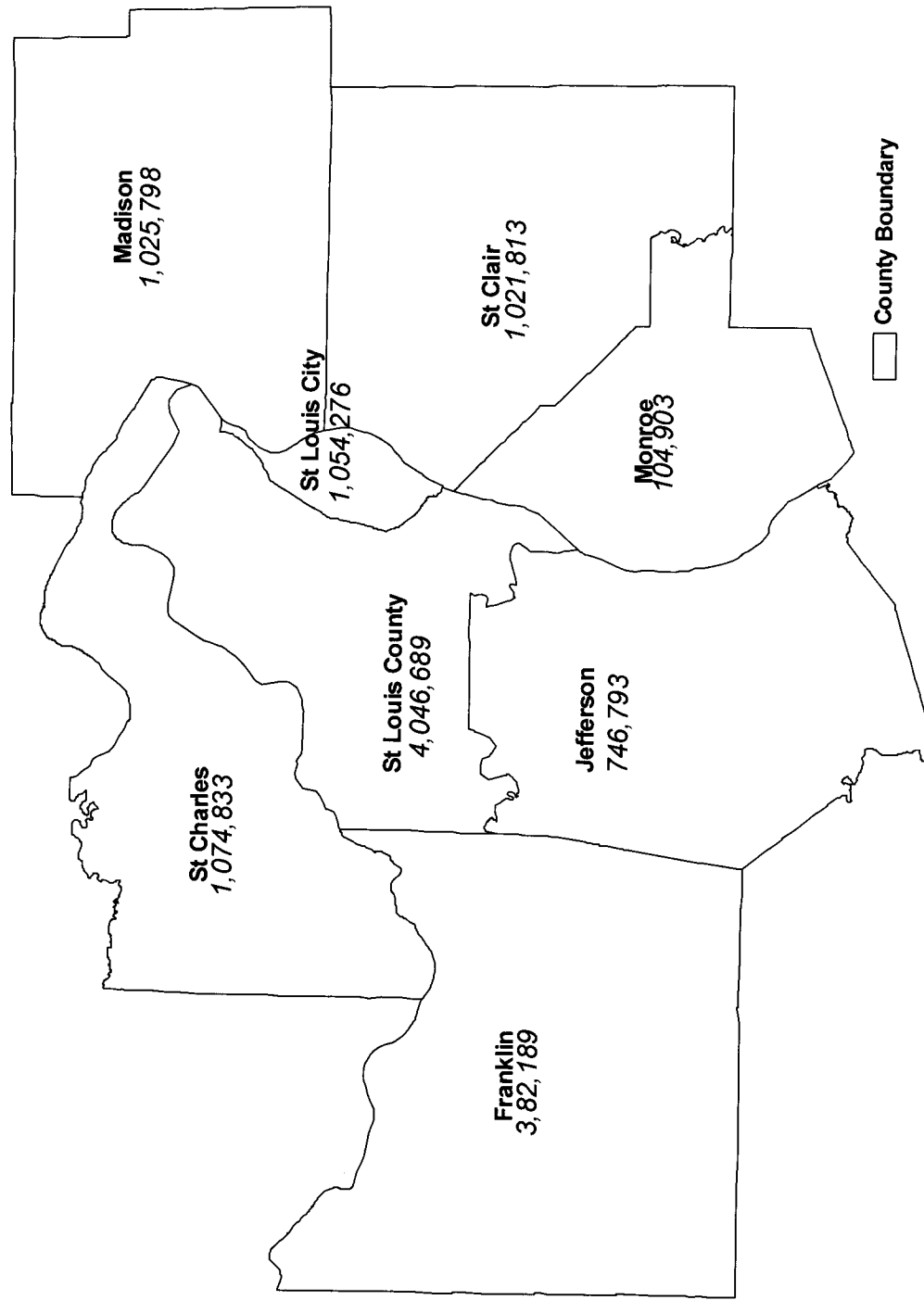
³ Total person trips include "other" modes.

⁴ Vehicle trips were defined as auto, van, truck driver or passenger trips and motorcycle trips.

⁵ Transit trips were defined as public bus, Metrolink, and taxi, shuttle, and limo trips.

⁶ Non-motorized trips were defined as walk and bike trips.

FIGURE 2: TOTAL WEEKDAY PERSON TRIPS BY COUNTY WITHIN THE ST. LOUIS REGION



Data collected by NUSTATS
 Coverage data provided by East-West Gateway Council 2002.
 Projection: State Plane NAD 1983 Missouri East

To provide context for the results of the Household Travel Survey for the St. Louis region, key statistics were compared with results from recent surveys in other metropolitan areas. In order to validate the comparison, all statistics in Table 7 were calculated using the same formulas from data weighted to Census 2000 parameters. Each of the studies was conducted by NuStats and employed the same procedures and methodology.

Relative to other metropolitan areas in Table 7, households in St. Louis made significantly more trips, with the exception of households in Anchorage. These higher rates of travel were evidenced even as household size and vehicle ownership were similar across the metropolitan areas. Other barometers for the resultant rates of travel are the average trip indicators included in the NCHRP Report #365. This report cites an average daily trip rate per household of 8.5 trips for urban areas with approximately one million households.

TABLE 7: COMPARATIVE METRO AREA STATISTICS

	ST. LOUIS (EWGCC)	ANCHORAGE (AMATS)	PHILADELPHIA (DVRPC)	KNOXVILLE (KUA MPO)	COLUMBUS (MORPC)
Total Persons	2,482,935	260,283	6,188,463	687,249	1,540,157
Total Households	968,533	95,080	2,321,679	281,514	610,895
Year of Survey	2002	2002	2000	2000	1999
Sample Size	5,000	1,400	5,700	1,500	5,500
Household Size	2.5	2.6	2.4	2.4	2.5
Household Vehicles	1.7	2.0	1.6	1.8	1.7
Person Trip Rate	4.0	4.1	3.5	3.8	3.8
Household Trip Rate	9.8	10.3	8.1	8.2	9.5

All statistics derived from weighted sample data. St. Louis estimates have been rounded up and therefore may not match exactly other estimates in this report.

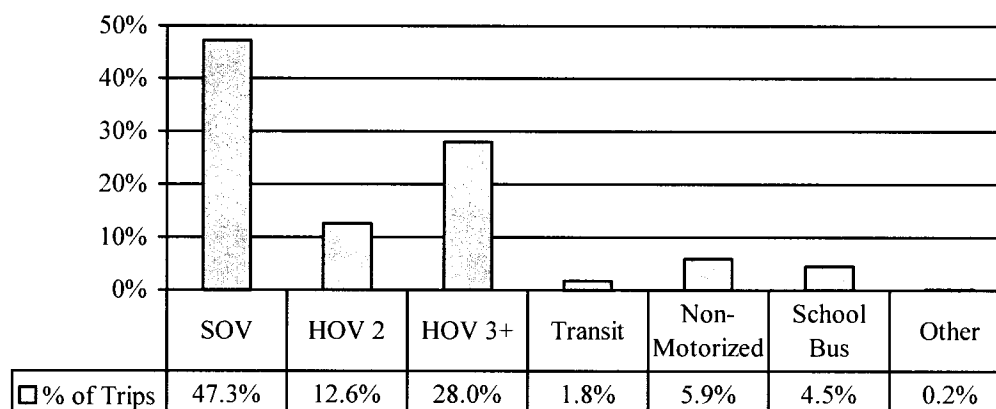


TRAVEL AND ACTIVITY PATTERNS

MODE OF TRAVEL

Nearly 9.5 million unlinked person trips were made within the St. Louis region on an average weekday. Nearly half of these trips (47 percent) were made in single-occupancy vehicles (SOV). This estimate reflects nearly 4.5 million SOV trips on an average weekday. Rideshare trips accounted for 41 percent of all trips, of which more than half were vehicles with three or more persons. Almost six percent of trips were via walking or biking, and two percent were by transit.

FIGURE 3: MODE OF TRAVEL FOR DAILY PERSON TRIPS



Base: 46,909 unlinked trips weighted by geography, household size, and vehicle ownership and expanded to represent 9,457,294 total trips in the St. Louis region.

St. Louis County accounted for nearly half of trip origins and destinations on an average weekday. Of the remaining counties in the region, St. Louis City, St. Clair County, and St. Charles County also had high numbers of trip origins and destinations.

TABLE 8: PERSON TRIP ORIGINS AND DESTINATIONS BY COUNTY

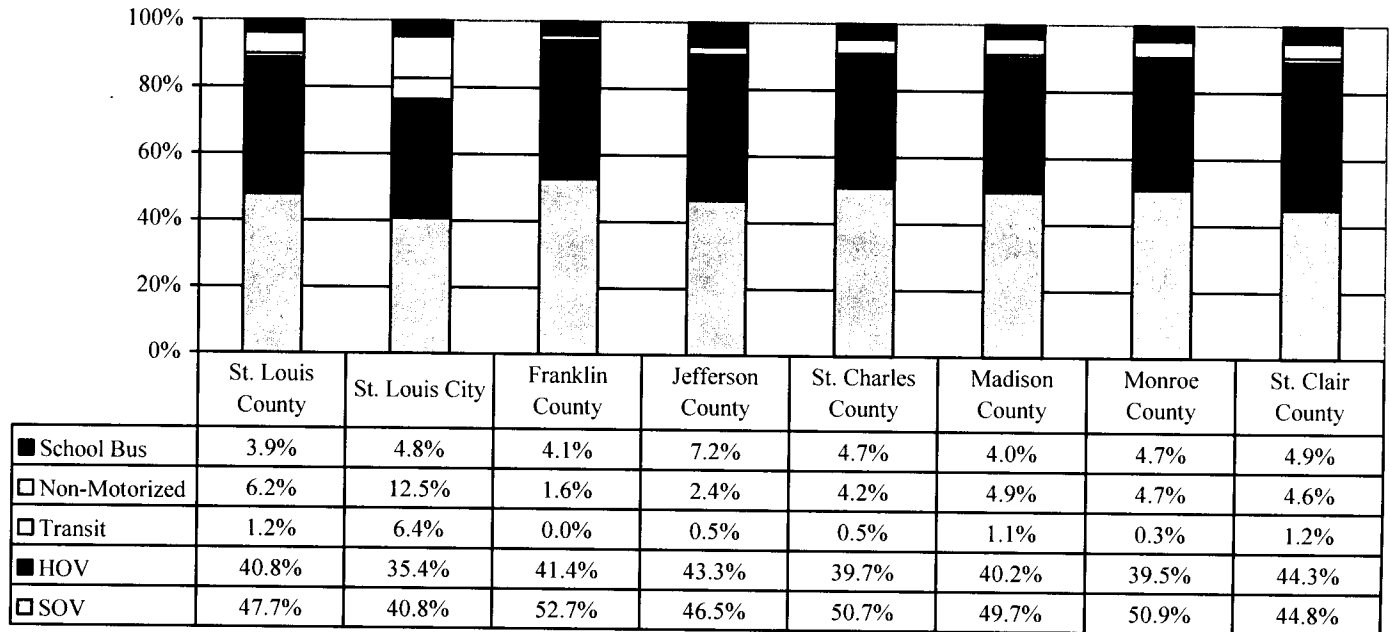
County	Trip Origins	Percent	Trip Destinations	Percent
St. Louis County	4,037,304	42.7	4,030,578	42.6
St. Louis City	1,407,772	14.9	1,407,877	14.9
St. Clair County	976,475	10.3	976,735	10.3
St. Charles County	962,487	10.2	962,020	10.2
Madison County	929,692	9.8	929,232	9.8
Jefferson County	610,334	6.5	605,522	6.4
Franklin County	339,035	3.6	338,343	3.6
Monroe County	87,892	0.9	87,934	0.9
Out of Area	106,304	1.1	119,052	1.3
Total	9,457,294	100.0	9,457,294	100.0

Base: 46,909 unlinked trips weighted by geography, household size, and vehicle ownership and expanded to represent 9,457,294 total trips in the St. Louis region.

Households varied in their choice of travel mode according to their county of residence (See Figure 4). For instance, SOV was the dominant mode for trips made by households located in Franklin, St. Charles and Monroe Counties.

On the other hand, trips made by households located in Jefferson and St. Clair were as likely to be HOV trips as they were to be SOV trips. Households located in St. Louis City made the greatest volume of transit trips. Non-motorized (mostly walk) trips were reported in greatest volumes among households located in St. Louis City.

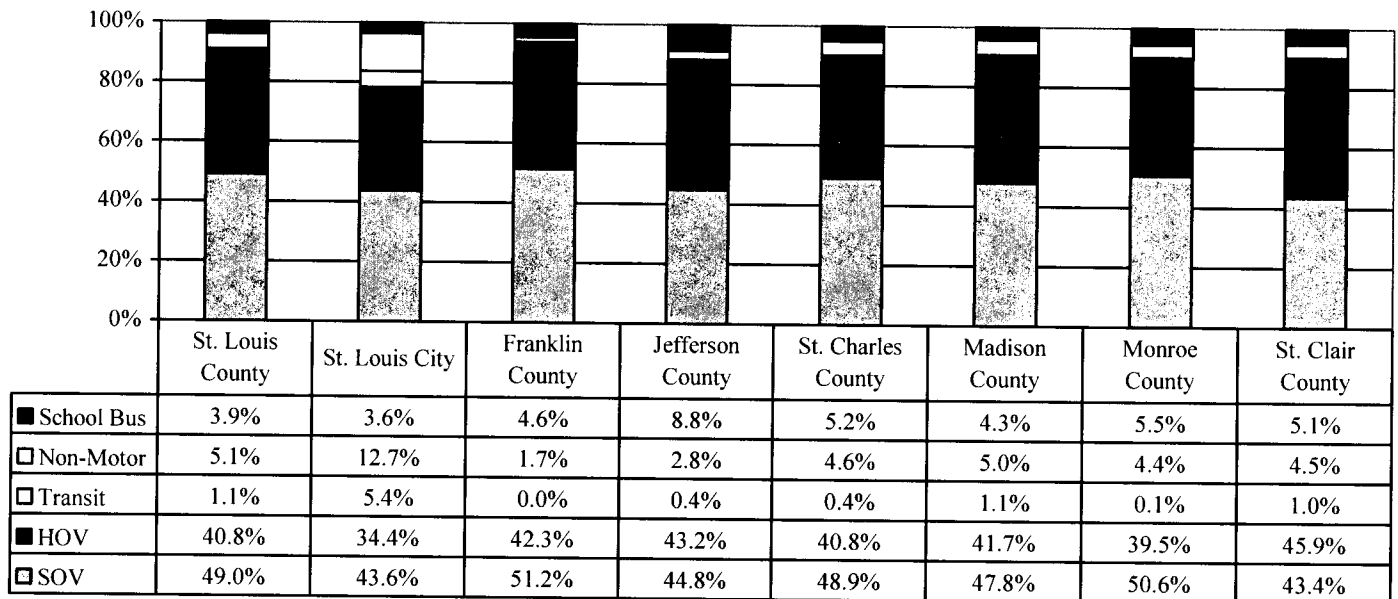
FIGURE 4: MODE OF TRAVEL BY COUNTY OF HOME LOCATION



Base: 46,909 unlinked trips weighted by geography, household size, and vehicle ownership and expanded to represent 9,457,294 total trips in the St. Louis region

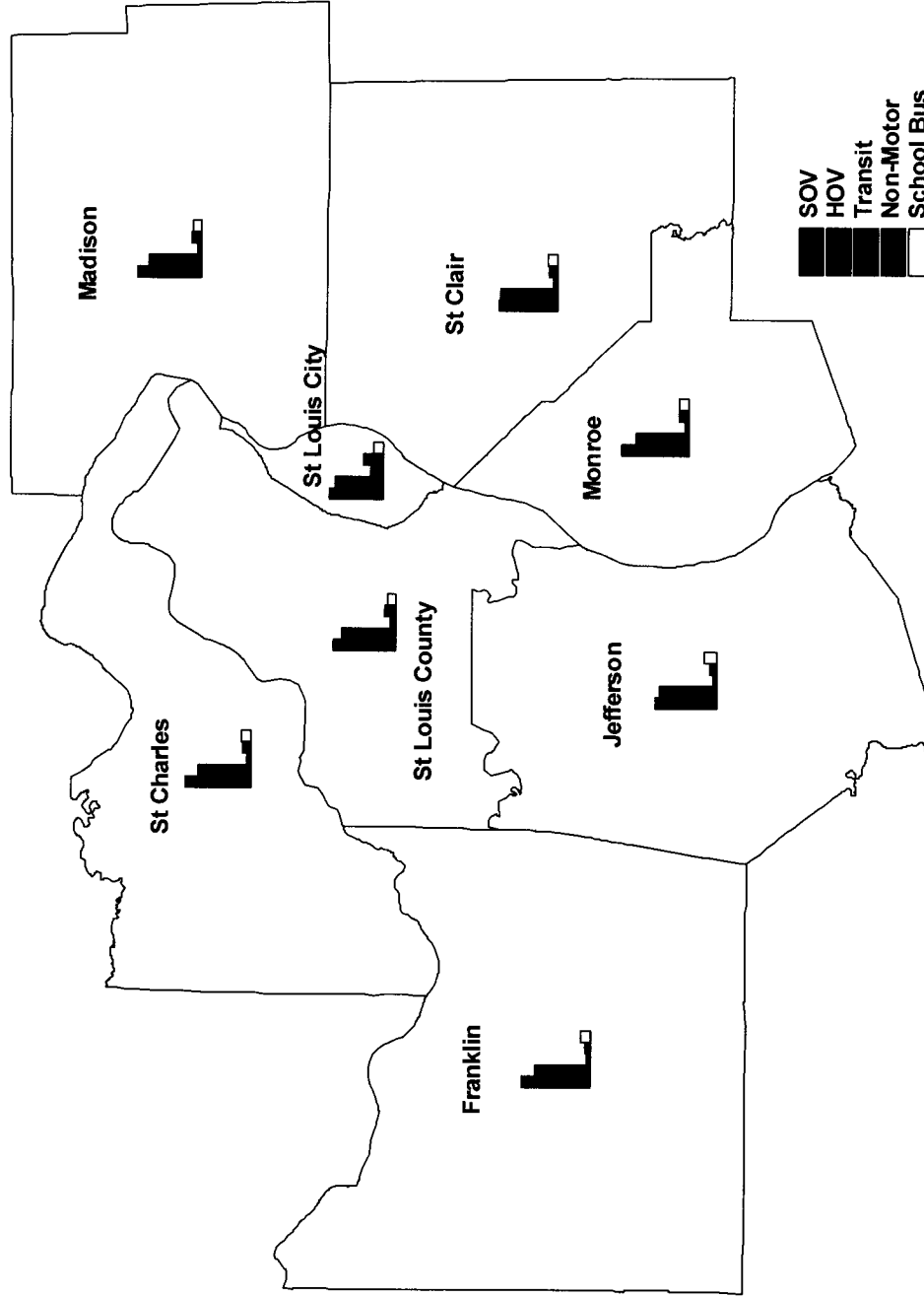
Mode usage by county of destination location showed only slight differences with mode usage by county of residence location. SOV usage was slightly higher for trips ending in St. Louis County and St. Louis City. HOV usage was slightly higher for trips ending in Franklin, St. Charles, Madison, and St. Clair Counties.

FIGURE 5: MODE OF TRAVEL BY COUNTY OF DESTINATION LOCATION



Base: 46,909 unlinked trips weighted by geography, household size, and vehicle ownership and expanded to represent 9,457,294 total trips in the St. Louis region

FIGURE 6: MODE OF TRAVEL BY COUNTY OF HOME LOCATION

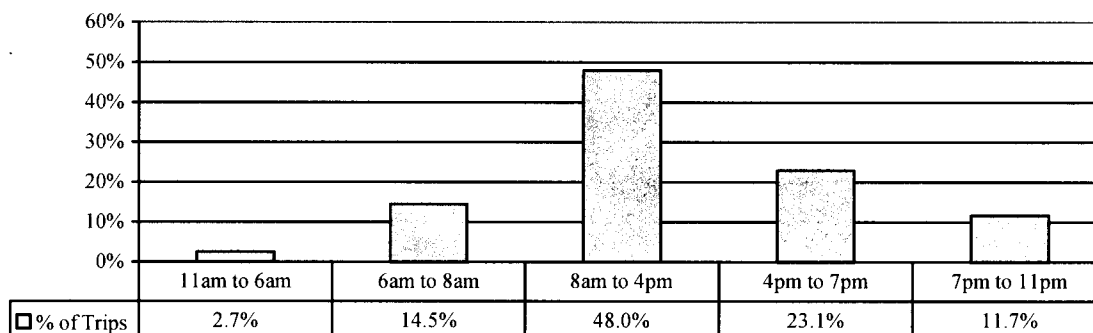


Data collected by NUSATS
 Coverage data provided by East-West Gateway Council 2002
 Projection: State Plane NAD 1983 Missouri East

TIME OF TRAVEL

PM Peak (4 p.m. to 7 p.m.⁷) was the time of day with the heaviest concentrated travel (23 percent of trips in a 3-hour period). The two peak periods (AM and PM) accounted for 38 percent of all trips. About 12 percent of all trips took place during the evening hours (7 p.m. to 11 p.m.).

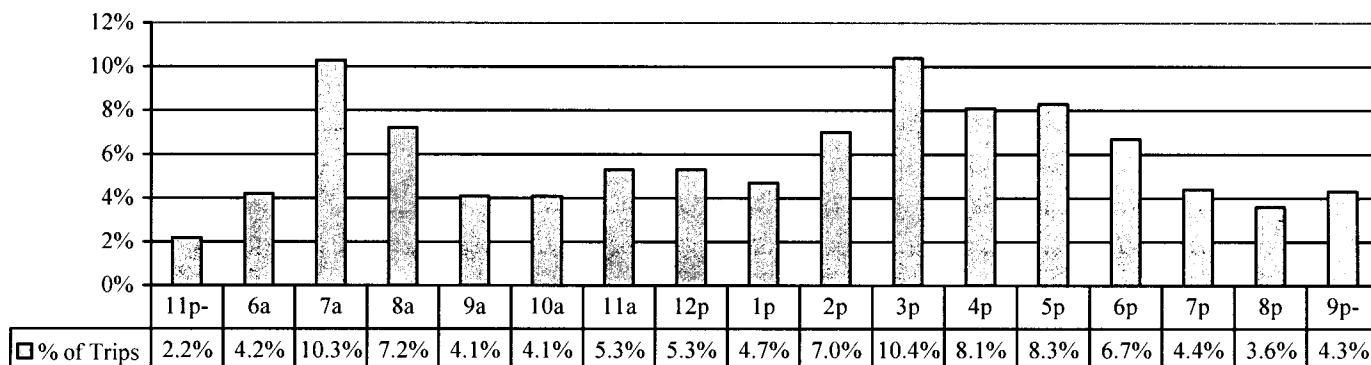
FIGURE 7: TRIP DISTRIBUTION BY TIME OF DAY



Base: 46,909 unlinked trips weighted by geography, household size, and vehicle ownership and expanded to represent 9,457,294 total trips in the St. Louis region

On an average day, most trips were made between 3 p.m. and 7 p.m. During the morning hours, trip making was the heaviest between 7 a.m. and 9 a.m. The shoulder periods for the PM Peak were significantly more heavily traveled than those of the AM Peak.

FIGURE 8: TRIP DISTRIBUTION BY TRIP DEPARTURE HOUR

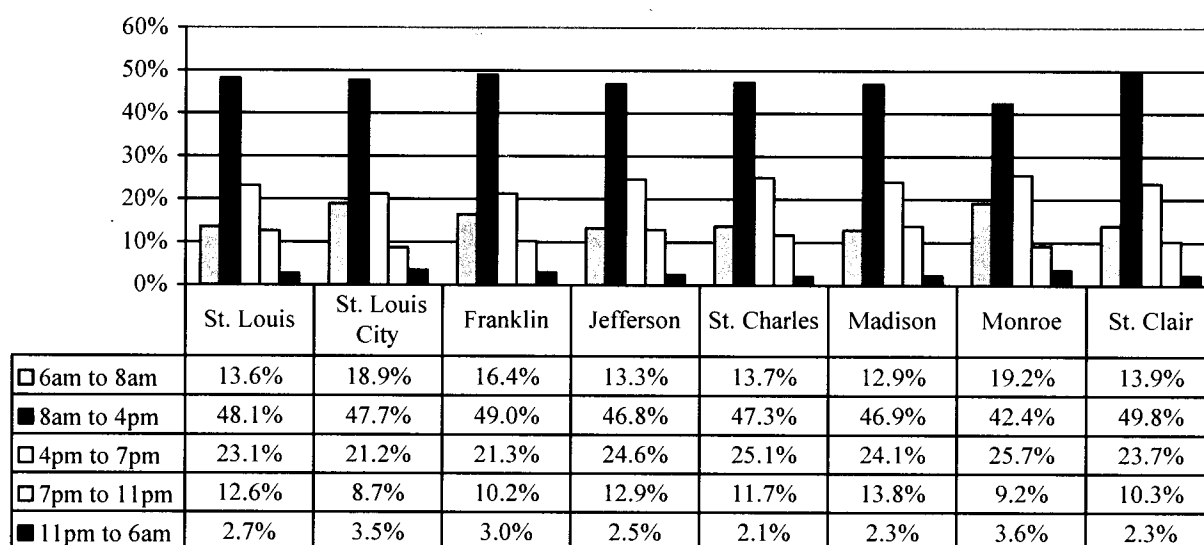


Base: 46,909 unlinked trips weighted by geography, household size, and vehicle ownership and expanded to represent 9,457,294 total trips in the St. Louis region

Time of travel did not vary significantly by county of residence. There were a few slight differences worth noting. For example, households in St. Louis City and Monroe County appeared to travel more frequently than residents of other counties during the AM peak period, while those in Jefferson, St. Charles, and Monroe Counties appeared to travel more frequently than residents of other counties during the PM peak.

⁷ Definitions for time periods were provided by EWGCC.

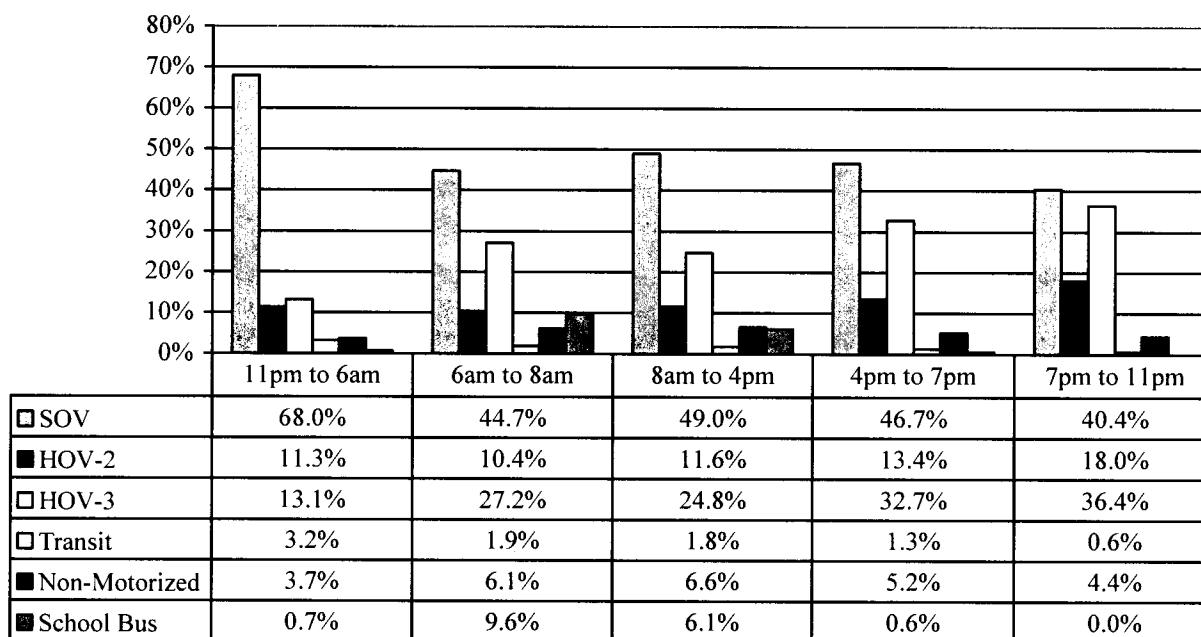
FIGURE 9: TRIP DISTRIBUTION BY TIME OF DAY BY COUNTY OF RESIDENCE



Base: 46,909 unlinked trips weighted by geography, household size, and vehicle ownership and expanded to represent 9,457,294 total trips in the St. Louis region

Traveling households tended to shift from SOV to HOV as the day progressed. HOV comprised 38 percent of the AM Peak period, 46 percent of the PM Peak, and 54 percent of the evening time period. At the same time SOV comprised 68 percent of the late night period, 45 percent of the AM Peak period, and 40 percent of the evening time period. On the other hand, transit use diminished as the day progressed. Non-motorized modes (i.e., walk and bike) were used throughout the day.

FIGURE 10: MODE OF TRAVEL DISTRIBUTION BY TIME OF DAY

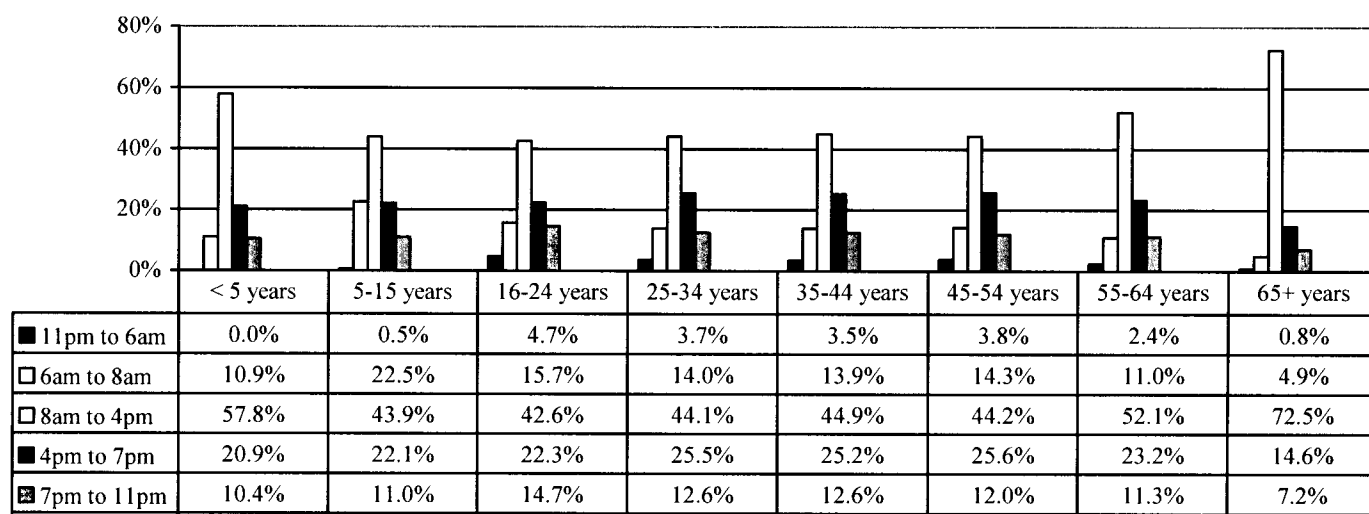


Base: 46,909 unlinked trips weighted by geography, household size, and vehicle ownership and expanded to represent 9,457,294 total trips in the St. Louis region

These findings were related to the fact that trip purpose changed as the day progressed and that mode choice was associated with trip purpose. During the evening there were more trips for non-work purposes like shopping and eat meals for which vehicle occupancy was typically higher than for work trips.

Times of travel varied by age. The majority of persons age 65+ (72 percent) traveled during the midday (8 a.m. to 4 p.m.). Children less than 5 years of age tended to travel during the mid-day period, as well. Young adults, 16-24 years, spread their travel among all time periods, whereas older adults traveled most frequently during midday and PM Peak periods.

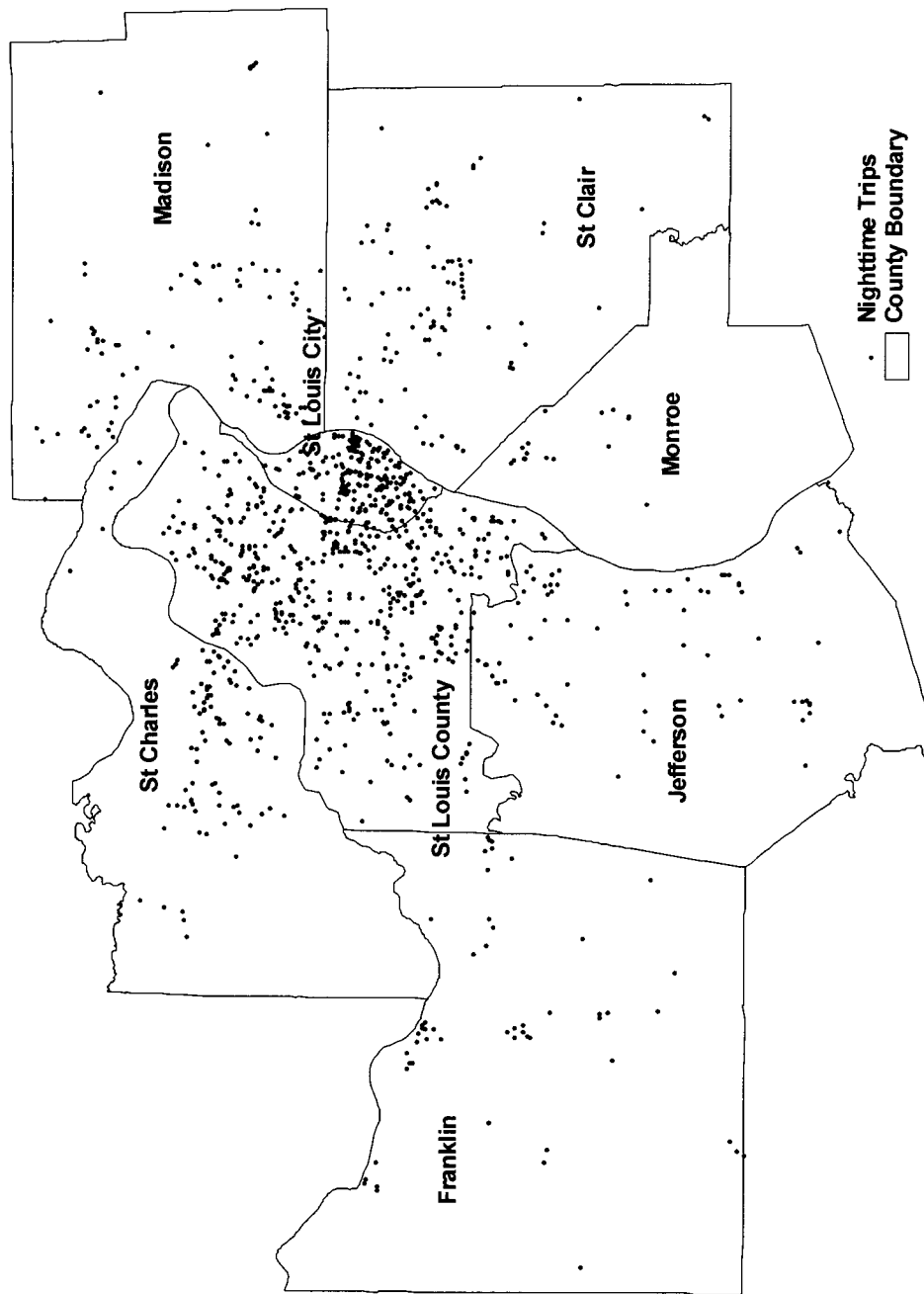
FIGURE 11: TIME OF TRAVEL BY AGE



Base: 46,909 unlinked trips weighted by geography, household size, and vehicle ownership and expanded to represent 9,457,294 total trips in the St. Louis region

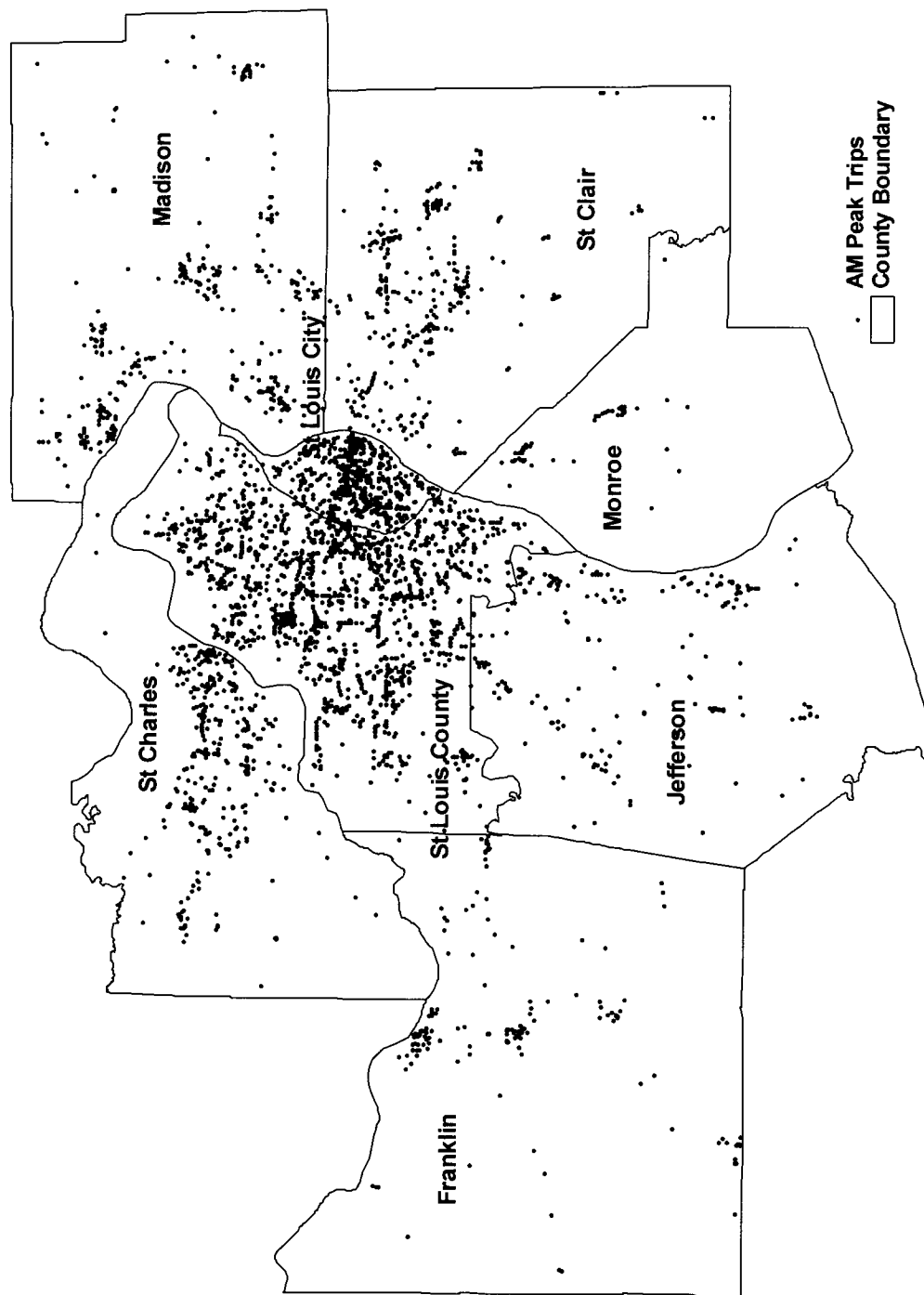
The destinations traveled to within the region did vary by time period. The five following maps illustrate trip destinations by each of the five time periods defined by EWGCC.

FIGURE 12: DESTINATIONS FOR NIGHTTIME TRIPS (11P.M. TO 6 AM.)



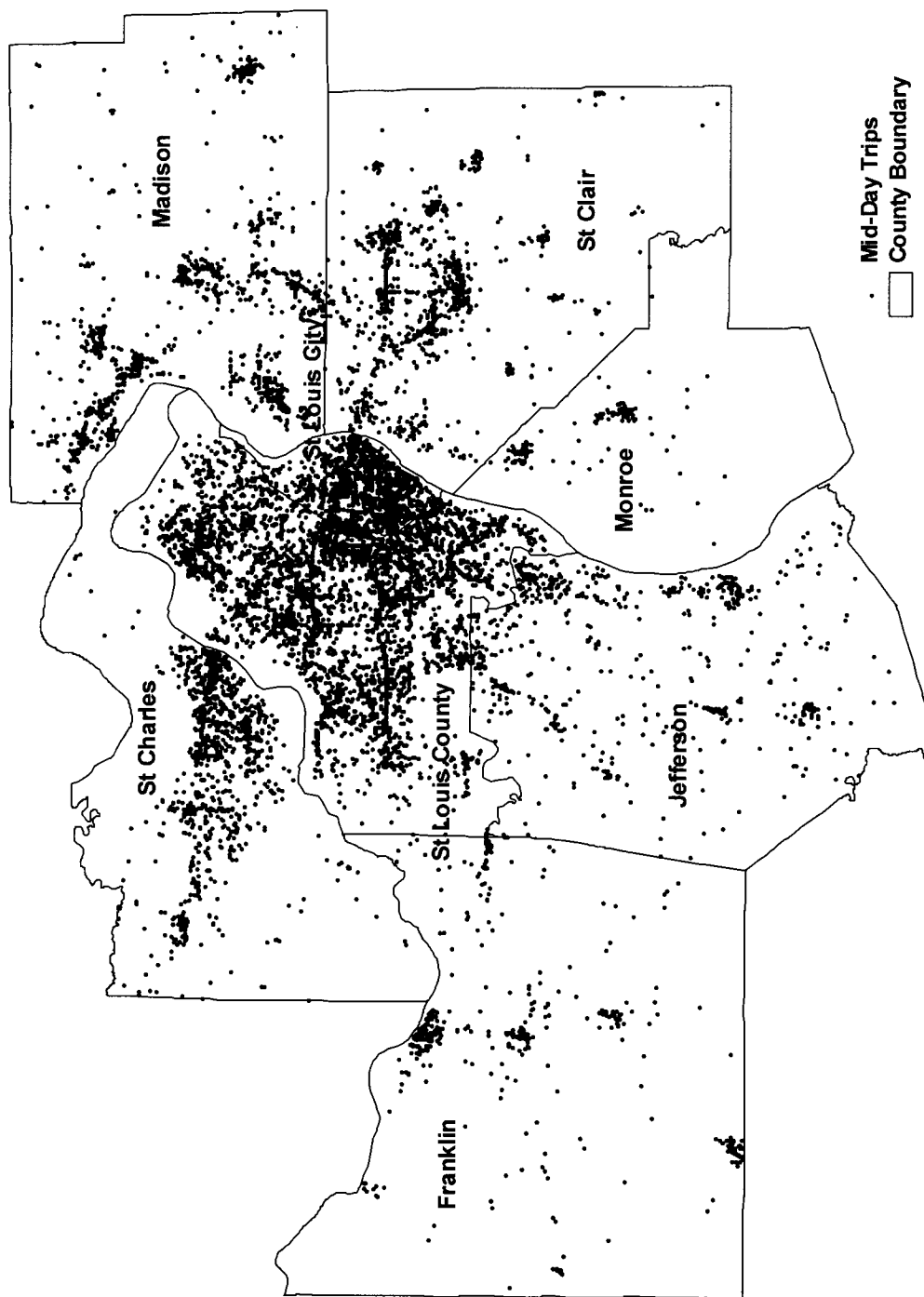
Data collected by NuStats.
Coverage data provided by East-West Gateway Council 2002.
Projection: State Plane NAD 1983 Missouri East

FIGURE 13: DESTINATIONS FOR AM PEAK TRIPS (6 A.M. TO 8 A.M.)



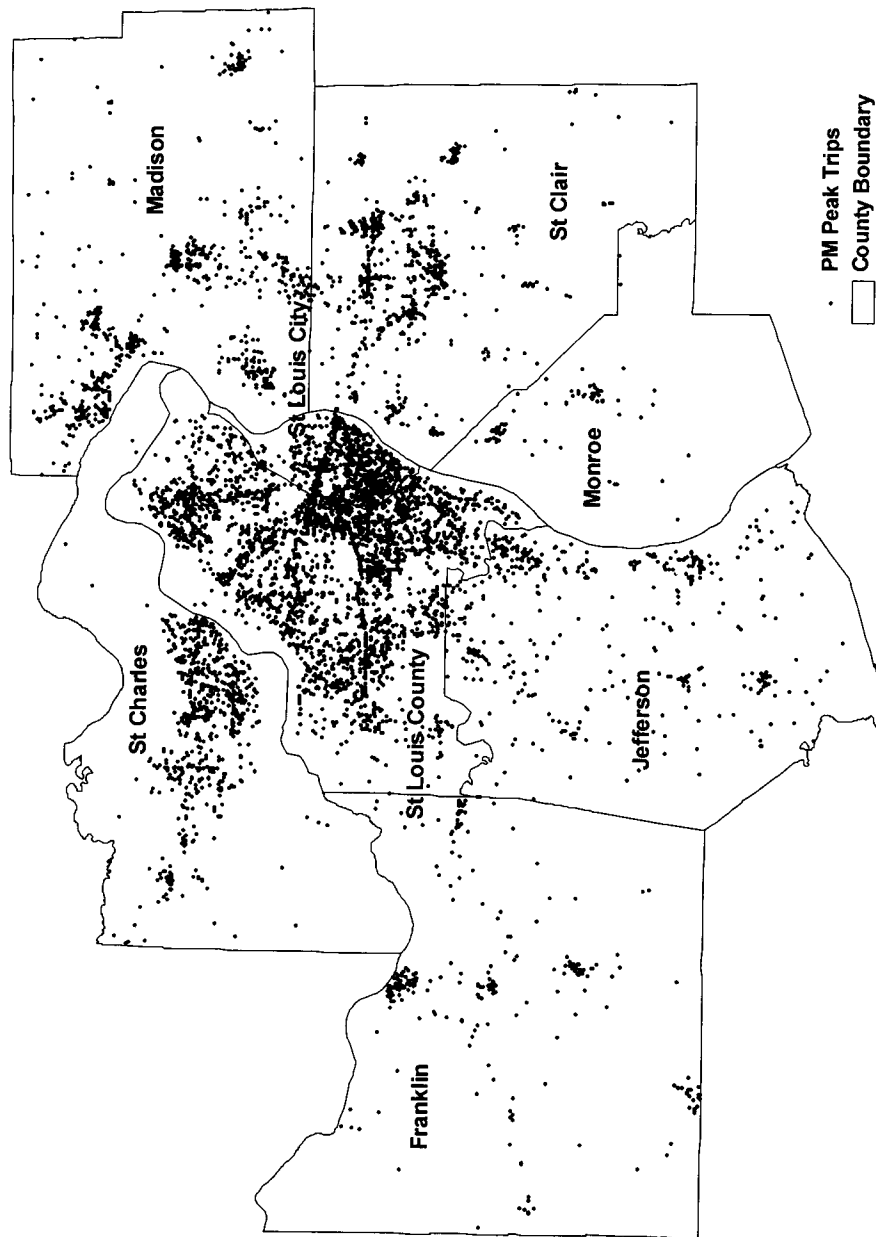
Data collected by NUSATS
 Coverage data provided by East-West Gateway Council 2002.
 Projection: State Plane NAD 1983 Missouri East

FIGURE 14: DESTINATIONS FOR MIDDAY TRIPS (8 A.M. TO 4 P.M.)



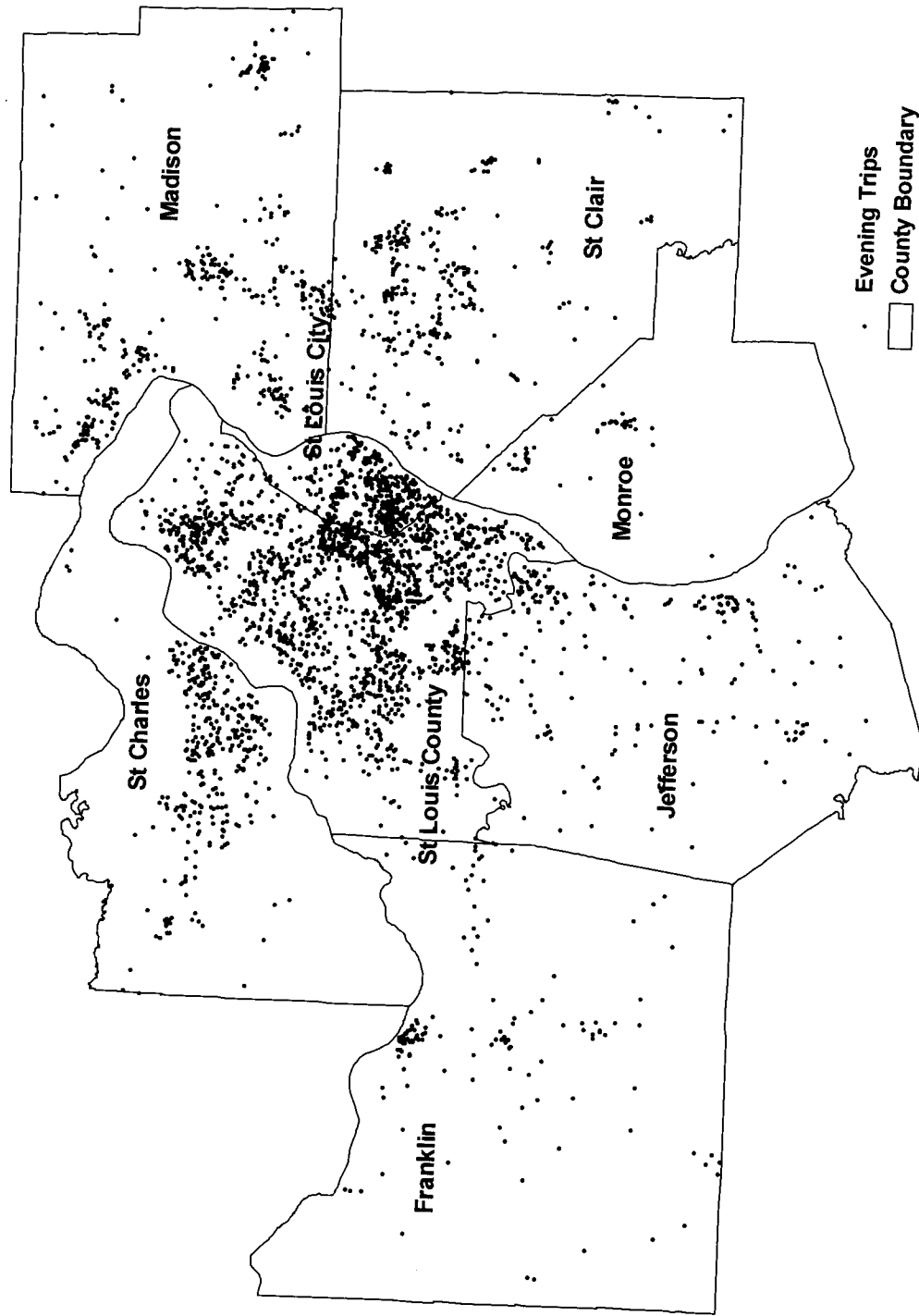
Data collected by NuStats
 Coverage area provided by East-West Gateway Council 2002.
 Projection: State Plane NAD 1983 Missouri East

FIGURE 15: DESTINATIONS FOR PM PEAK TRIPS (4 P.M. TO 7 P.M.)75



Data collected by NUSTATS
 Copyright © 2002 by East-West Gateway Council
 Project: St. Louis Metro 1993 National Data

FIGURE 16: DESTINATIONS FOR EVENING TRIPS (7 P.M. TO 11 P.M.)

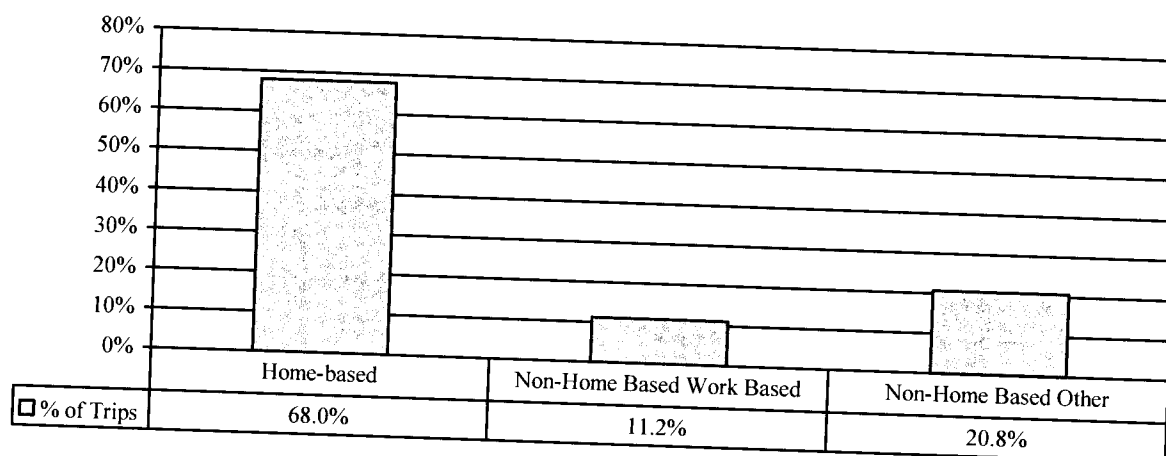


Data collected by NuStat
 Coverage date provided by East-West Gateway Council 2002.
 Projection: State Plane NAD 1983 Missouri East

PURPOSE FOR TRAVEL

Of the nearly 9.5 million unlinked trips taken in the St. Louis Region on an average weekday, most were home-based. Of the home-based trips, the most prevalent trip purposes were work (15 percent), school-related (11 percent) and shopping (10 percent). Non home-based trips comprised one-third of the trip sample (32 percent). Of these, most (22 percent) were **not** to or from work. Of the non home-based trips that were to or from work, most were for shopping / eating, to pick up or drop-off passenger, or to make a quick stop.

FIGURE 17: SUMMARY TRIP PURPOSES



Base: 46,909 unlinked trips weighted by geography, household size, and vehicle ownership and expanded to represent 9,457,294 total trips in the St. Louis region.

TABLE 9: DETAILED TRIP PURPOSES

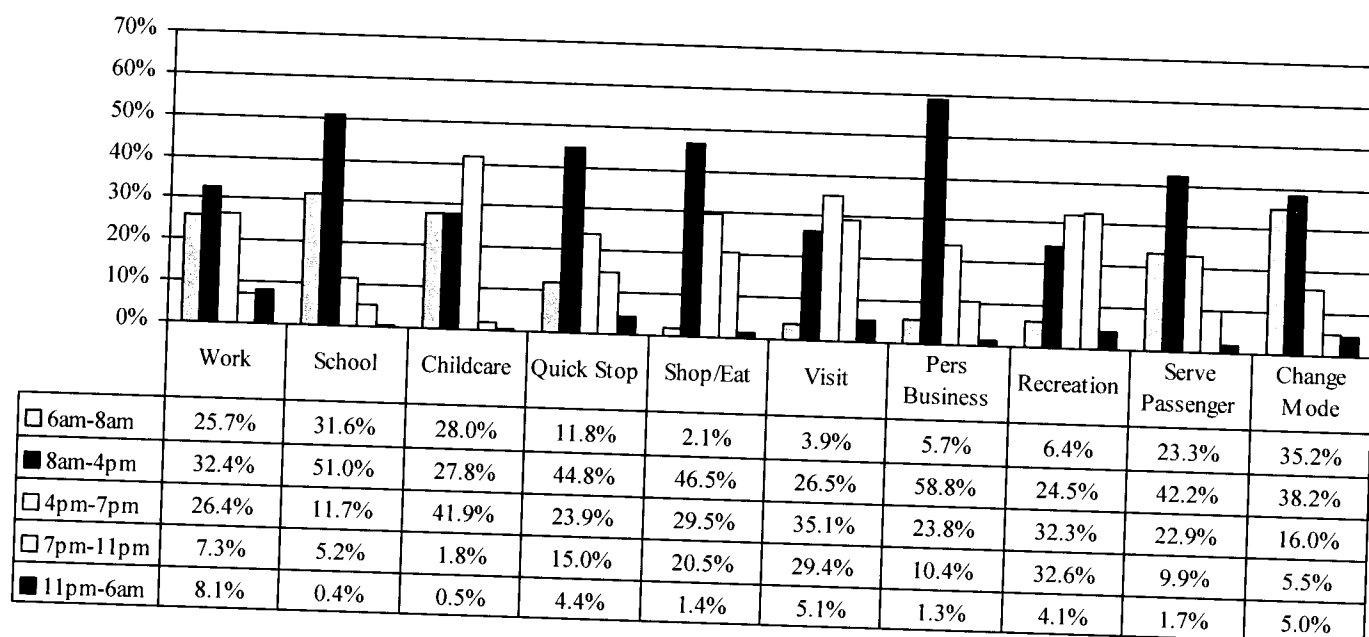
Trip Purpose	Frequency	Percent
Home-Based Trips	6,433,912	68.0
Home-Based Work	1,454,935	15.4
Home-Based School-related	1,097,833	11.6
Home-Based Shop, Eat	961,186	10.2
Home-Based Pick-up / Drop-off Passenger	839,203	8.9
Home-Based Personal Business	692,999	7.3
Home-Based Recreation	606,607	6.4
Home-Based Visit	342,575	3.6
Home-Based Quick Stop	282,065	3.0
Home-Based Change Mode	112,995	1.2
Home-Based Childcare	43,514	0.5
Non Home-Based Work-Based Trips	1,054,651	11.2
Non Home-Based Work-Based Shop, Eat	264,424	2.8
Non Home-Based Work-Based Work	217,698	2.3
Non Home-Based Work-Based Pick-up / Drop-off Passenger	192,987	2.0
Non Home-Based Work-Based Quick Stop	124,623	1.3
Non Home-Based Work-Based Personal Business	121,519	1.3
Non Home-Based Work-Based Recreation	44,188	0.5
Non Home-Based Work-Based Visit	37,600	0.4

Trip Purpose	Frequency	Percent
Non Home-Based Work-Based Change Mode	36,028	0.4
Non Home-Based Work-Based School-related	15,584	0.2
Non Home-Based Other	1,968,730	20.8
Total	9,457,293	100.0

Base: 46,909 unlinked trips weighted by geography, household size, and vehicle ownership and expanded to represent 9,457,294 total trips in the St. Louis region. Number of valid cases is different from total count because cell counts have been rounded.

Trips to or from work, as well as childcare trips, were evenly spread among the AM Peak, mid-day, and PM Peak periods. Trips to or from school were focused in the mid-day period, as were trips for personal business. Shopping trips were largely distributed between the mid-day and PM Peak periods. Quick stop trips were much more likely to take place during mid-day period and to occur with greater frequency in the PM Peak than in the AM Peak. Shopping and eating trips were concentrated in the mid-day period with a secondary concentration during the PM peak. Visiting and recreation trips typically took place between 4 p.m. and 11 p.m.

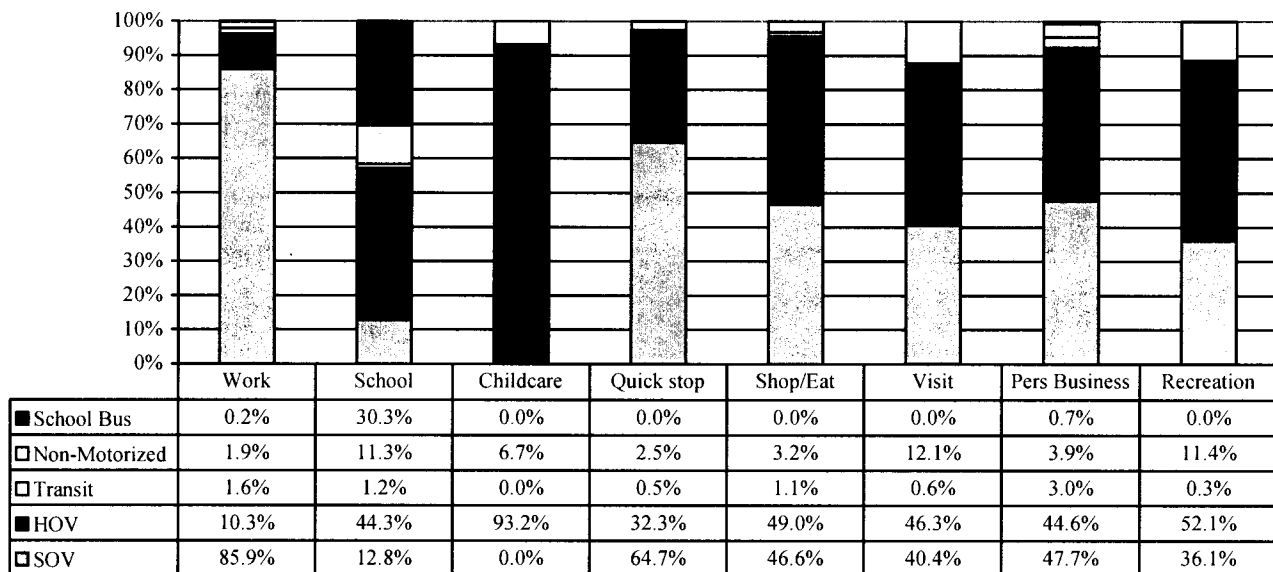
FIGURE 18: HOME-BASED TRIP PURPOSE BY TIME OF DAY



Base: 46,909 unlinked trips weighted by geography, household size, and vehicle ownership and expanded to represent 9,457,294 total trips in the St. Louis region

The majority of work trips (88% percent) were made in an SOV. Most trips to school were also made in a vehicle, with 13 percent in an SOV, and 44 percent in an HOV, 30 percent by school bus, and one percent by transit. Half of all shopping trips (49 percent) were via HOV, with slightly less (47 percent) by SOV.

FIGURE 19: MODE OF TRAVEL BY HOME-BASED TRIP PURPOSE⁸

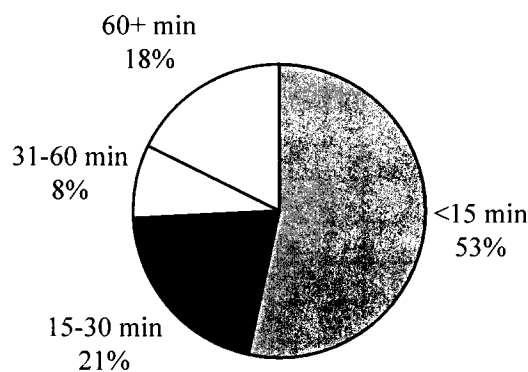


Base: 46,909 unlinked trips weighted by geography, household size, and vehicle ownership and expanded to represent 9,457,294 total trips in the St. Louis region

TRIP DURATION

Overall, the unlinked trips recorded in the travel survey were short. More than half (53 percent) were less than 15 minutes in length. Only 18 percent of trips took longer than 60 minutes. Reported trip lengths by households located in Jefferson County were significantly longer than those reported by households in other counties. Trip lengths in St. Charles County and St. Louis City were also comparatively long. Households in Madison County reported the shortest trip lengths on average.

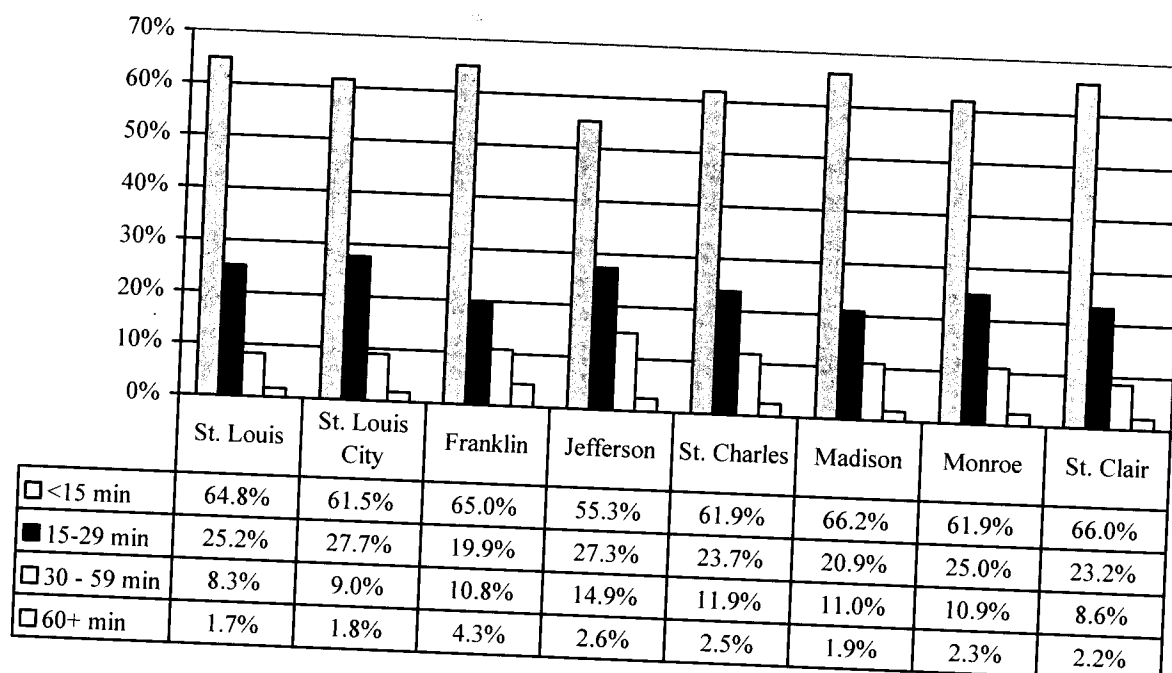
FIGURE 20: DISTRIBUTION OF TRIP DURATION



Base: 46,909 unlinked trips weighted by geography, household size, and vehicle ownership and expanded to represent 9,457,294 total trips in the St. Louis region

⁸ Only trip purposes for which this analysis would be interesting were included in this figure.

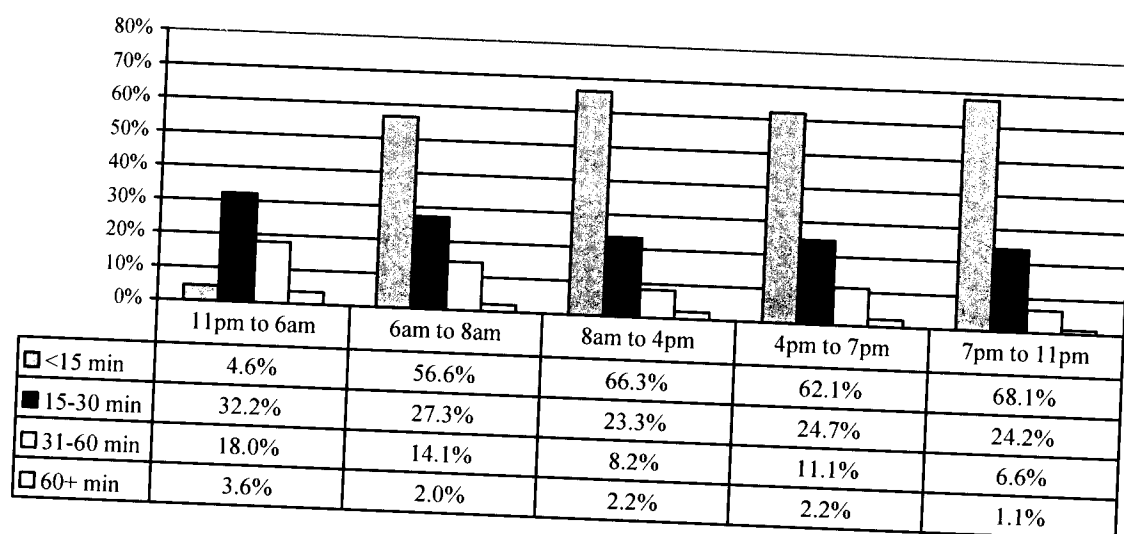
FIGURE 21: TRIP DURATION BY COUNTY OF HOME LOCATION



Base: 46,909 unlinked trips weighted by geography, household size, and vehicle ownership and expanded to represent 9,457,294 total trips in the St. Louis region.

The shortest trips were reported during the evening (7 p.m. to 11 p.m.) and the longest were reported in the late evening (11 p.m. to 6 a.m.). The average trip length during evening was 15.6 minutes, and during the late evening the average reported trip duration was 25.1 minutes. The average trip length was 19.9 minutes in the AM Peak, 17.3 in the midday, and 18.2 in the PM Peak.

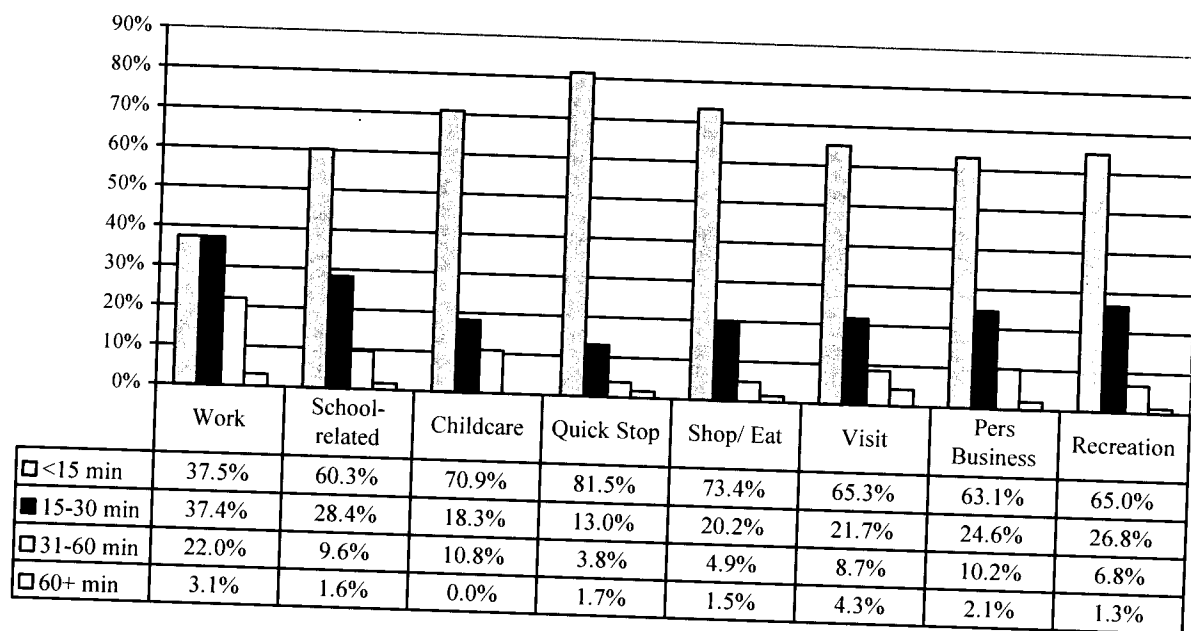
FIGURE 22: TRIP DURATION BY PERIOD OF DAY



Base: 46,909 unlinked trips weighted by geography, household size, and vehicle ownership and expanded to represent 9,457,294 total trips in the St. Louis region

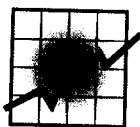
Trips for consumer purposes (i.e., quick stop, personal business, shop/eat, recreation) were the shortest as they were most likely done quite close to home or work. The longest trips were for work.

FIGURE 23: TRIP DURATION BY HOME-BASED TRIP PURPOSE⁹



Base: 46,909 unlinked trips weighted by geography, household size, and vehicle ownership and expanded to represent 9,457,294 total trips in the St. Louis region.

⁹ Only trip purposes for which this analysis would be interesting were included in this figure.



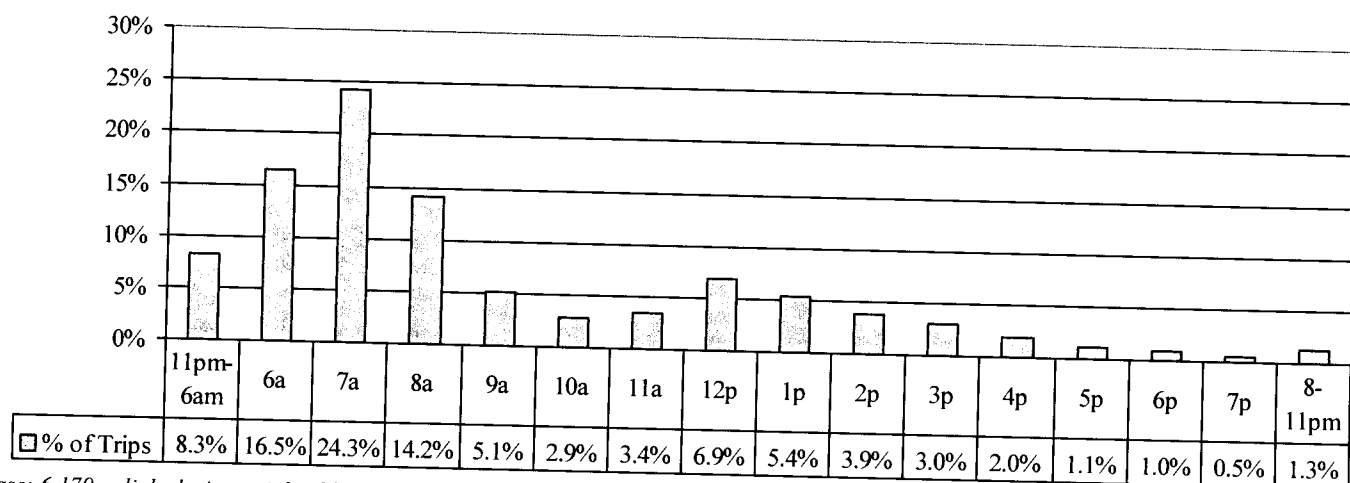
SPECIALIZED TRAVEL: WORK AND PEAK PERIOD

Because of their unique characteristics and significance to transportation planning, specialized analyses were done on trips to work and trips taken during the a.m. and p.m. peak periods.

TRAVEL FOR WORK

On an average weekday, 2,187,177 work trips were taken (Figure 26 on page 25 illustrates the work destinations). The highest volume of trips to work was between 7 a.m. and 8 a.m. The hour before this period (6 a.m.-7 a.m.) and the hour after (8 a.m.-9 a.m.) had about the same volume of trips to work. The total three-hour morning period accounted for nearly 55% of all daily work trips. There was evidence of some split shifts, with about 12% percent of work trips starting between noon and 2 p.m.

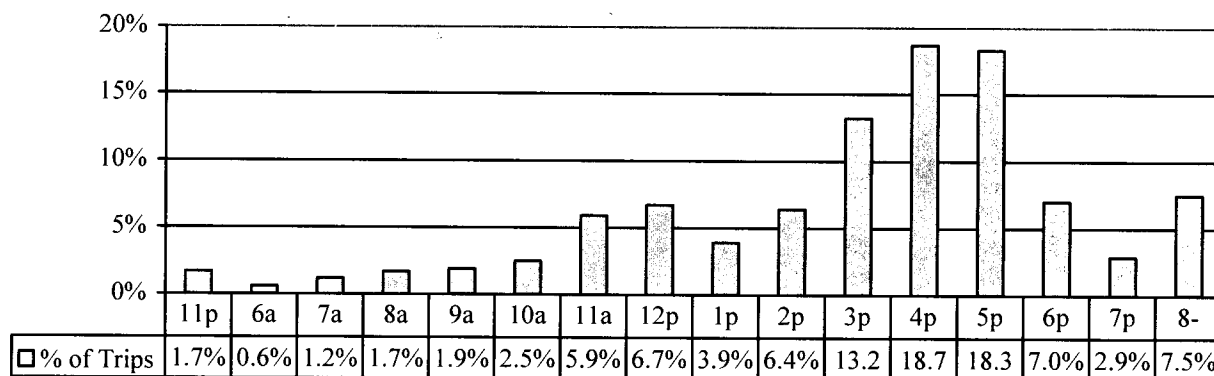
FIGURE 24: STARTING HOUR FOR TRIPS TO WORK



Base: 6,179 unlinked trips weighted by geography, household size, and vehicle ownership and expanded to represent 1,098,321 total trips to work in the St. Louis Region

Trips from work occurred most frequently between the hours of 4 p.m. and 6 p.m. A significant amount of trips from work occurred between 3 p.m. and 4 p.m. There was a sharp drop-off in trips from work after 6 p.m.

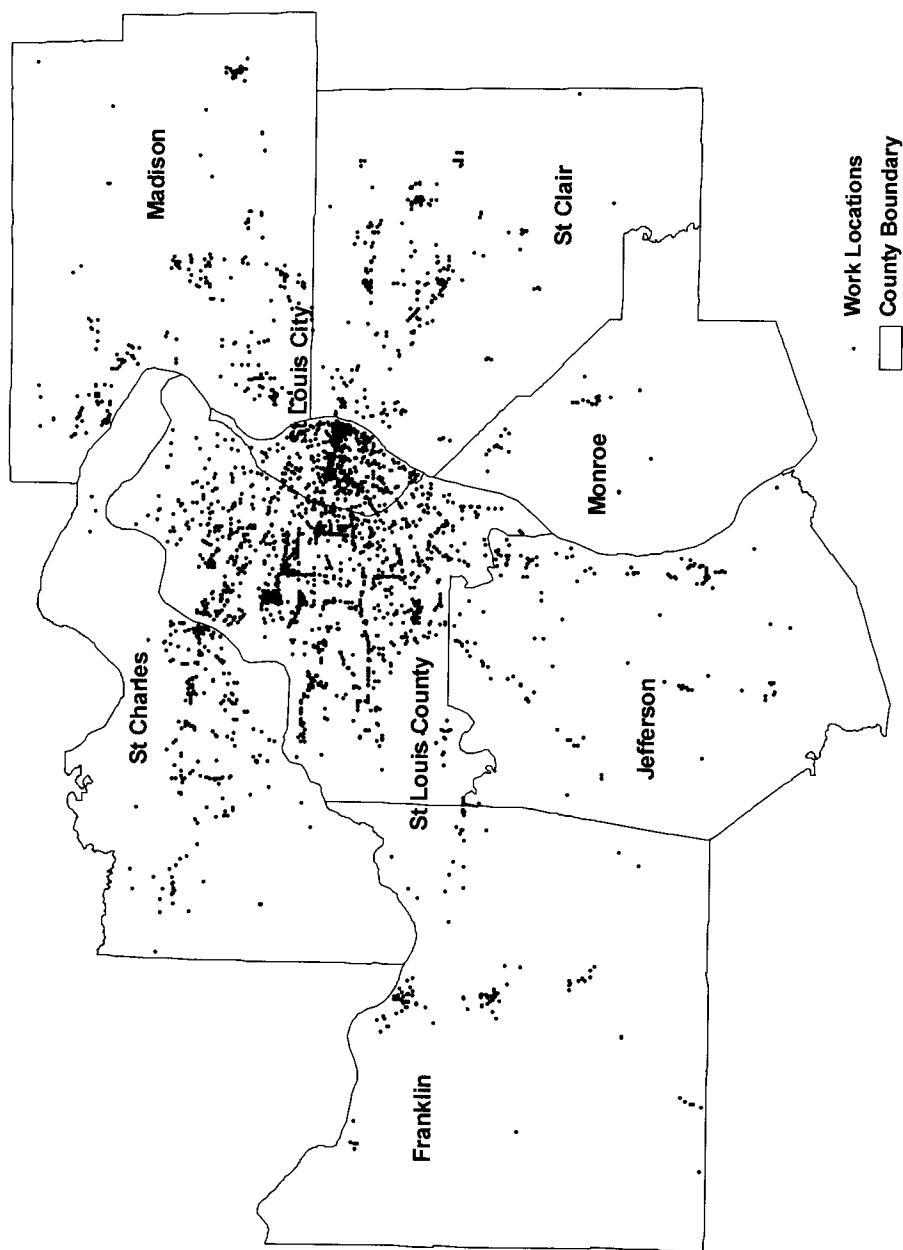
FIGURE 25: STARTING HOUR FOR TRIPS FROM WORK



Base: 6,200 unlinked trips weighted by geography and household size and expanded to represent 1,104,974 total trips from work in the St. Louis region.¹⁰

¹⁰ The total trips "to work" and "from work" will sum to 2,203,295 trips. This number is higher than the 2,187,177 total weekday work trips noted on this page. This is because there were 16,188 (expanded) trips that were "from work to work" trips.

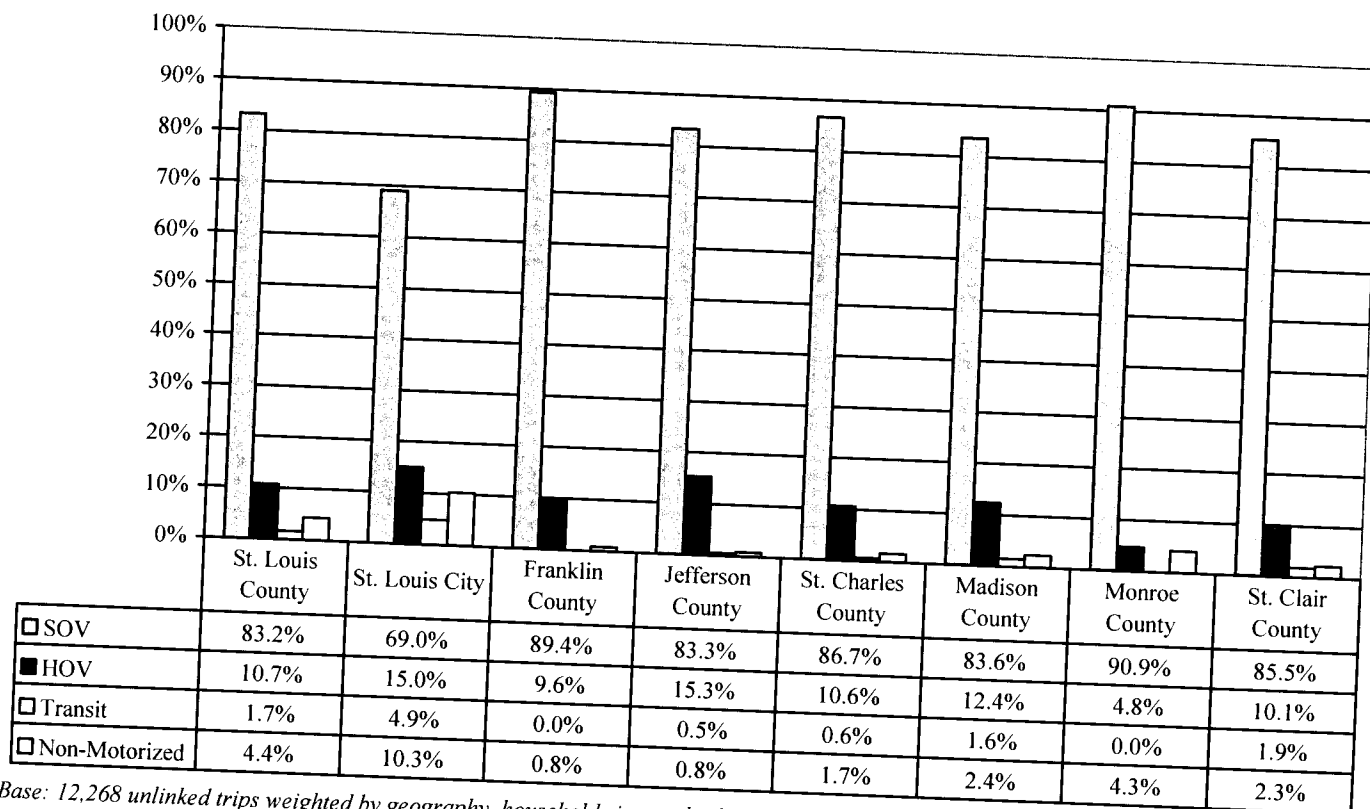
FIGURE 26: GEOGRAPHIC DISTRIBUTION OF WORK LOCATIONS



Data collected by NuStats
 Coverage data provided by East-West Gateway Council 2002.
 Projection: State Plane NAD 1983 Missouri East

SOV was the mode of choice for work trips. Households located in St. Louis City and Jefferson County used HOV most frequently. Households located in St. Louis City used transit most frequently. St. Louis City also evidenced a healthy number of non-motorized trips.

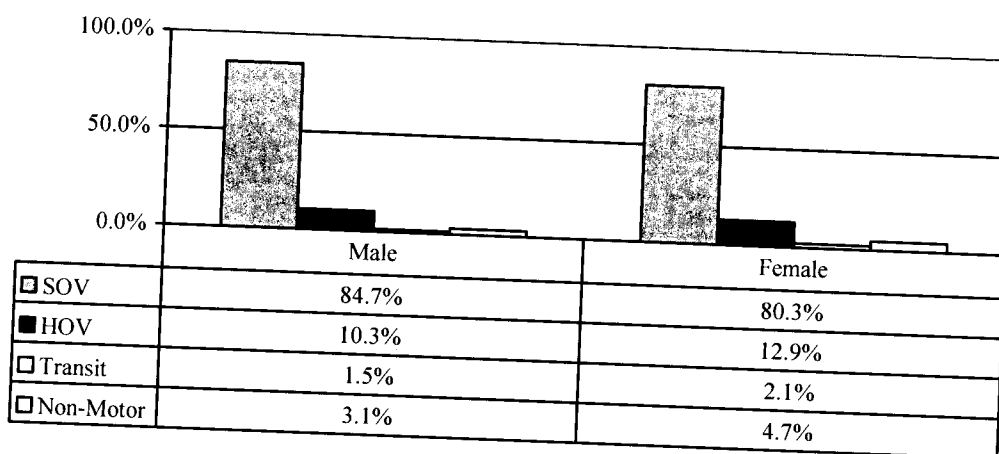
FIGURE 27: MODE OF WORK TRIP BY COUNTY OF RESIDENCE



Base: 12,268 unlinked trips weighted by geography, household size, and vehicle ownership and expanded to represent 2,187,174 total work trips in the St. Louis Region. Percents may not total 100% due to the slight number of trips that used school bus for trips to work that are not included in this table.

Females were more likely than males to travel to work via HOV.

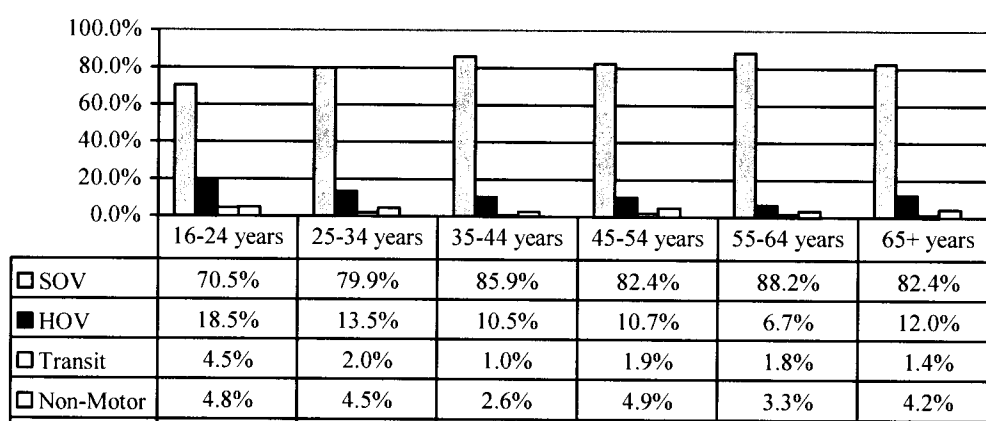
FIGURE 28: MAIN MODE OF TRIP TO WORK BY GENDER



Base: 12,268 unlinked trips weighted by geography, household size, and vehicle ownership and expanded to represent 2,187,174 total work trips in the St. Louis Region. Percents may not total 100% due to the slight number of trips that used school bus for trips to work that are not included in this table.

Mode to work varied significantly by age of worker, with younger persons in the workforce more likely to rely on modes other than SOV for their travel to work. SOV usage was highest among persons 55–64 years of age.

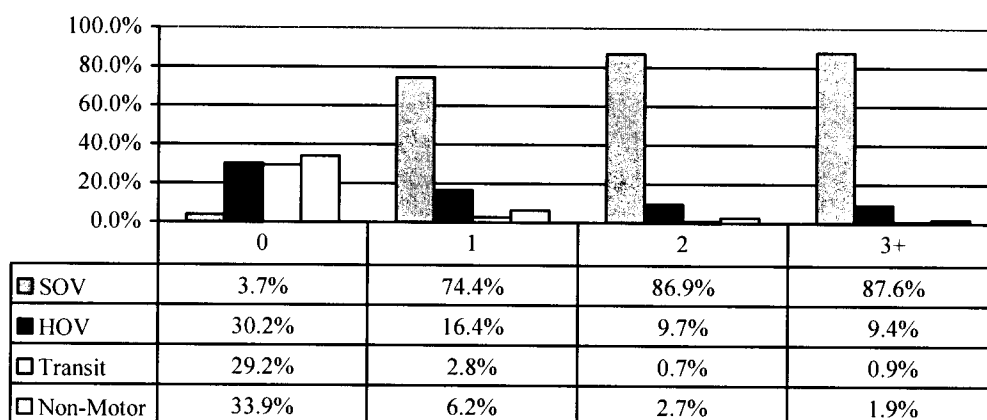
FIGURE 29: MAIN MODE OF TRIP TO WORK BY AGE



Base: 12,268 unlinked trips weighted by geography, household size, and vehicle ownership and expanded to represent 2,187,172 total work trips in the St. Louis Region. Percents may not total 100% due to the slight number of trips that used school bus for trips to work that are not included in this table.

As might be expected, vehicle ownership was a significant indicator of mode of travel to work. Persons in households with zero vehicles relied on nonmotorized modes and public transit to get to work to a significantly greater degree than persons in households with vehicles. HOV use was higher among this latter group, as well as among persons in households with only one vehicle. Generally, as vehicle ownership increased, reliance on means other than SOV decreased significantly.

FIGURE 30: MAIN MODE OF TRIP TO WORK BY VEHICLE OWNERSHIP



Base: 12,268 unlinked trips weighted by geography and household size and expanded to represent 2,187,177 total work trips in the St. Louis Region. Percents may not total 100% due to the slight number of trips that used school bus for trips to work that are not included in this table.

PEAK PERIOD TRAVEL¹¹

For purposes of this report, the AM Peak was defined by EWGCC as 6 a.m. to 8 a.m. On an average weekday, 1,369,297 trips took place during this time period. The PM Peak was defined as 4 p.m. to 7 p.m. On an average weekday, 2,189,216 trips took place during the PM Peak. St. Louis County accounted for the largest proportion of peak period origins and destinations. St. Louis City accounted for significantly more of the AM peak trip destinations than all other counties, with the exception of St. Louis County. In the PM peak, St. Louis City, St. Charles County, St. Clair County, and Madison County all accounted for comparative proportions of destinations.

TABLE 10: AM PEAK TRIP ORIGINS AND DESTINATIONS BY COUNTY¹²

County	Trip Origins	%	Trip Destinations	%
St. Louis County	533,370	39.0	547,362	40.0
St. Louis City	189,220	13.8	266,272	19.4
St. Charles County	159,020	11.6	131,516	9.6
St. Clair County	151,638	11.1	135,644	9.9
Madison County	138,840	10.1	120,132	8.8
Jefferson County	112,322	8.2	80,282	5.9
Franklin County	61,951	4.5	55,532	4.1
Monroe County	18,657	1.4	16,852	1.2
Out of Area	4,279	0.3	15,704	1.1
Total	1,369,297	100.0	1,369,297	100.0

Base: 6,373 unlinked trips weighted by geography and household size and expanded to represent 1,369,297 AM Peak trips in the St. Louis region.

TABLE 11: PM PEAK TRIP ORIGINS AND DESTINATIONS BY COUNTY

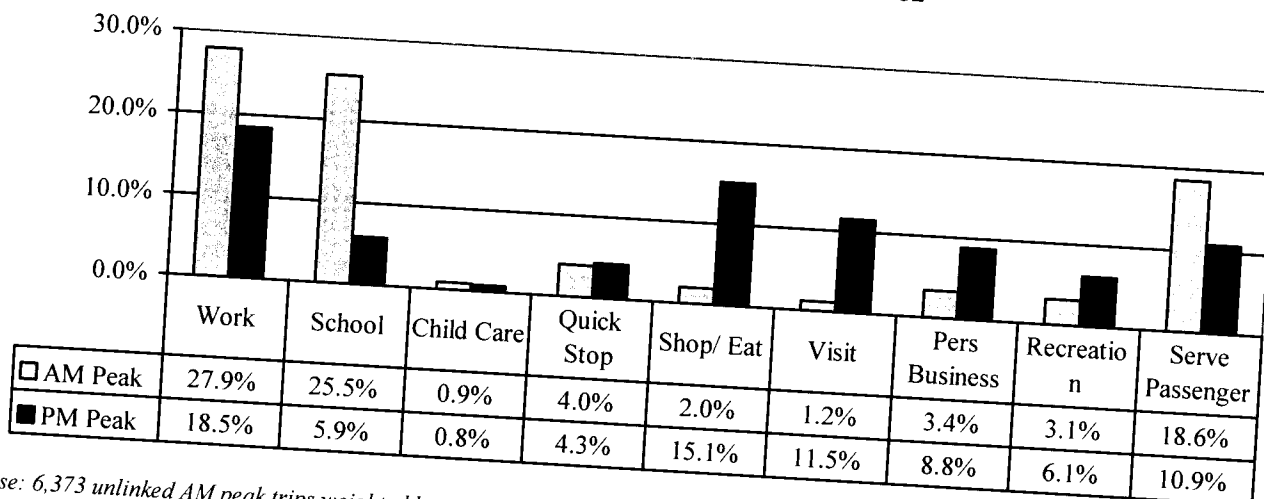
County	Trip Origins	%	Trip Destinations	%
St. Louis County	930,504	42.5	956,953	44.5
St. Louis City	297,846	13.6	284,716	13.2
St. Charles County	241,663	11.0	229,352	10.7
St. Clair County	231,409	10.6	234,693	10.9
Madison County	223,525	10.2	206,659	9.4
Jefferson County	148,717	6.8	125,782	5.7
Franklin County	72,183	3.3	68,482	3.1
Monroe County	22,575	1.0	19,034	0.9
Out of Area	20,794	0.9	26,763	1.2
Total	2,240,815	100.0	2,240,815	100.0

Base: 11,039 unlinked trips weighted by geography and household size and expanded to represent 2,189,216 PM Peak trips in the St. Louis region.

¹¹ The EWGCC time periods may be re-defined based on this analysis.

There were definitely different patterns of travel derived by trip purpose between the two peak periods. AM Peak trips were dominated by work-based and school-based trips. There was a greater amount of non-utilitarian travel during the PM Peak, including shopping / eating out and visiting / recreation.

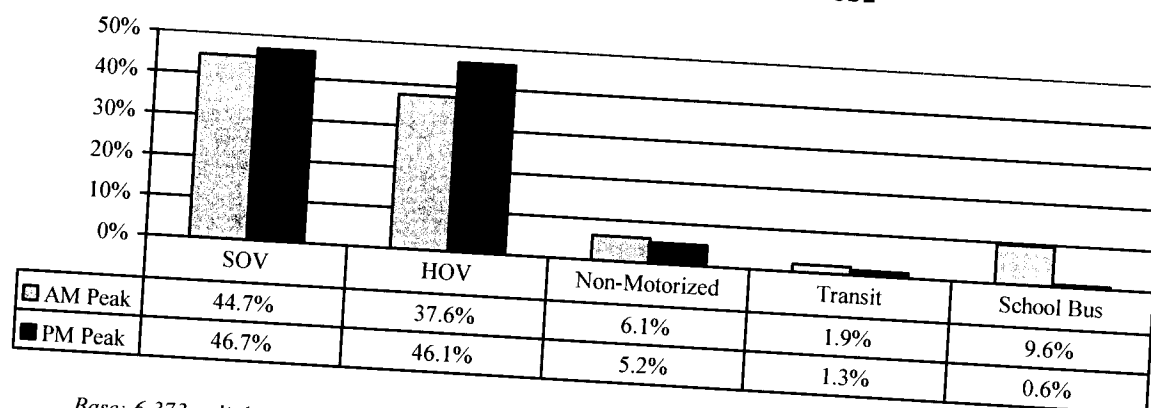
FIGURE 31: PEAK PERIOD TRIPS BY TRIP PURPOSE



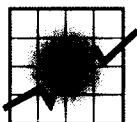
Base: 6,373 unlinked AM peak trips weighted by geography and household size and expanded to represent 1,369,297 AM Peak trips in the St. Louis region. 11,039 unlinked PM peak trips weighted by geography and household size and expanded to represent 2,189,216 PM Peak trips in the St. Louis region.

Compared to the AM Peak, PM Peak travel was more likely to be by HOV. On the other hand, school bus trips comprised nearly 9 percent of AM Peak trips and were nearly absent in the PM Peak.

FIGURE 32: PEAK PERIOD TRIPS BY TRAVEL MODE



Base: 6,373 unlinked AM peak trips weighted by geography and household size and expanded to represent 1,369,297 AM Peak trips in the St. Louis region. 11,039 unlinked PM peak trips weighted by geography and household size and expanded to represent 2,189,216 PM Peak trips in the St. Louis region.



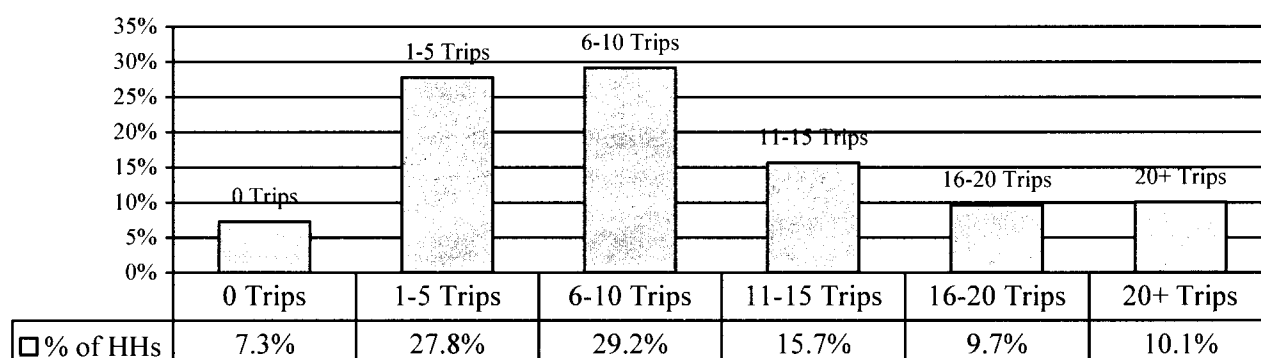
HOUSEHOLD CHARACTERISTICS AND TRAVEL

The 5,094 participating households provided important socioeconomic data that will provide insight into population characteristics for a variety of transportation planning and policy applications.

VOLUME OF TRIPS

Very few of the households (7.3 percent) that participated in the survey reported making “zero” trips on their travel day.¹³ Most households reported making 10 trips or less, but one in ten households (10 percent) reported making more than 20 trips on their travel day. Thus, the household survey data set contains a rich body of trip information for the study area.

FIGURE 33: NUMBER OF TRIPS PER HOUSEHOLD ON ASSIGNED TRAVEL DAY



Base: 5,094 Households in the St. Louis region, weighted by geography, household size, and vehicle ownership and expanded to represent all 968,533 households in the St. Louis region

Households in certain counties within the St. Louis region made more trips than households in other counties. While the county of St. Louis generated almost half of all trips in the region, the number of trips per household (10.01 trips per household) was less than for many other counties. The higher household trip rates can be accounted for by the larger household sizes in these three counties.

Highest rates of travel per household were found in Franklin, St. Charles, and St. Clair Counties, at 10.94, 10.57, and 10.55 trips per household, respectively. Jefferson County households reported on average 10.44 trips. Household trip rates in Madison County were comparable to those in St. Louis County. Households in St. Louis City reported the lowest household trip rates, by far, at 7.17 trips per household.

TABLE 12: HOUSEHOLDS AND TRIPS BY HOUSEHOLD LOCATION

County	# HHs	Percent	# Trips	Percent	Trips/HH
Franklin	34,945	3.6	382,189	4.0	10.94
St. Charles	101,663	10.5	1,056,328	11.4	10.57
St. Clair	96,810	10.0	1,021,812	10.8	10.55
Jefferson	71,499	7.4	746,793	7.9	10.44
Monroe	10,275	1.1	104,903	1.1	10.21
Madison	101,953	10.5	1,025,798	10.8	10.06
St. Louis	404,312	41.7	4,046,689	42.8	10.01
St. Louis City	147,076	15.2	1,054,276	11.1	7.17

¹³ This percent is well within the standard of no more than 8-10 percent of households and is a strong indicator of data quality.

County	# HHs	Percent	# Trips	Percent	Trips/HH
Total	968,533	100.0	9,457,294	100.0	9.76

Base: 5,094 Households in the St. Louis region, weighted by geography, household size, and vehicle ownership and expanded to represent all 968,533 households in the St. Louis region

HOUSEHOLD COMPOSITION AND TRIP-MAKING

As household size increased, the number of trips per household also increased. The largest volumes of trips were among the 2- and 4-person households.

TABLE 13: HOUSEHOLDS AND TRIPS BY HOUSEHOLD SIZE

Household (HH) Size	# HHs	Percent	# Trips	Percent	Trips/HH
1	268,090	27.7	1,072,887	11.3	4.00
2	308,670	31.9	2,417,433	25.6	7.83
3	160,997	16.6	1,838,116	19.4	11.42
4	138,538	14.3	2,245,794	23.7	16.21
5	62,211	6.4	1,186,788	12.5	19.08
6	20,209	2.1	481,137	5.1	23.81
7+	9,818	1.0	215,139	2.3	21.91
Total	968,533	100.0	9,457,294	100.0	9.76

Base: 5,094 Households in the St. Louis region, weighted by geography, household size, and vehicle ownership and expanded to represent all 968,533 households in the St. Louis region

Two household composition variables were significantly associated with household trip rates – number of workers and presence of school age children. There were 1,173,772 workers among the 968,533 households in the St. Louis region. This estimate represented 1.22 workers per household. One-worker households were most common (38 percent), and 31 percent of households had two workers. About one-quarter (24 percent) had zero workers in them. Less than one in ten (six percent) had three or more workers. The trips generated by employed persons were significant in the St. Louis region. Not only did employed persons make home to work trips, but also their increased spending power increased the number of non-work trips.

Households with two workers generated 40 percent of the reported trips in the survey. The trip rates of these two-worker households were over twice as high per household as zero-worker households (12.7 trips per household compared to 5.3 trips per household). While households with three or more workers were a small segment of the total population (six percent), they generated a disproportionately large volume of trips (nearly 17 trips per household).

TABLE 14: HOUSEHOLDS AND TRIPS BY NUMBER OF WORKERS

Workers	# HHs	%	# Trips	%	Trips/HH
0	233,176	24.1	1,226,755	13.0	5.26
1	372,953	38.5	3,367,128	35.6	9.03
2	300,040	31.0	3,812,254	40.3	12.71
3+	62,363	6.4	1,051,156	11.1	16.86
Total	968,533	100.0	9,457,293	100.0	9.76

Base: 5,094 Households in the St. Louis region, weighted by geography, household size, and vehicle ownership and expanded to represent all 968,533 households in the St. Louis region.

By far, the majority of households in the sample (64 percent) did not contain children (defined as persons 17 years of age and younger). Only slightly more than one-third (36 percent) of households in the St. Louis region contained one or more school age children.

The presence of school age children in the household was significantly associated with high trip making. Households with children generated nearly 60 percent of all trips recorded during the travel survey when they only represented 36 percent of all households. Households without children averaged 6.53 trips whereas those with children averaged 15.55 trips per household.

TABLE 15: HOUSEHOLDS AND TRIPS BY PRESENCE OF CHILDREN

Presence of Children	# HHs	Percent	# Trips	Percent	Trips/HH
Children	347,266	35.9	5,400,760	57.1	15.55
No Children	621,267	64.1	4,056,533	42.9	6.53
Total	968,533	100.0	9,457,293	100.0	9.96

Base: 5,094 Households in the St. Louis region, weighted by geography, household size, and vehicle ownership and expanded to represent all 968,533 households in the St. Louis region.

SOCIO-ECONOMIC STATUS AND TRIP-MAKING

Household income impacts trip making. Persons in households with incomes greater than \$45,000 reported significantly more trips than did those in households with incomes that were less than \$45,000. The median household income for the region was \$44,437, according to 2000 census data. One factor contributing to these higher trip rates was that higher income households typically had more household members. For example, households with household incomes less than \$15,000 contained an average of 1.8 persons, whereas those with household incomes greater than \$75,000 contained an average of 3.0 persons.

TABLE 16: HOUSEHOLDS AND TRIPS BY HOUSEHOLD INCOME

HH Income	#HHs	Percent	# Trips	Percent	Trips/HH
Less than \$4,999	22,393	2.3	105,249	1.3	4.70
\$5,000 to \$14,999	59,556	6.1	275,027	3.3	4.62
\$15,000 to \$24,999	98,710	10.2	693,757	8.4	7.03
\$25,000 to \$44,999	206,898	21.4	1,660,601	20.1	8.03
\$45,000 to \$74,999	231,330	23.9	2,597,017	31.5	11.23
\$75,000 or more	215,905	22.3	2,910,747	35.3	13.48
Missing	133,742	13.8	--	--	--
Total	968,534	100.0	8,242,398	100.0	9.76

Base: 5,094 Households in the St. Louis region, weighted by geography, household size, and vehicle ownership and expanded to represent all 968,533 households in the St. Louis region. Valid cases for #HHs may differ from totals presented elsewhere because of cell rounding.

Vehicle ownership in the St. Louis Region at 1.69 vehicles per household was lower than the national average (2.0 vehicles per household). Slightly more than 89,000 households in the region reported owning zero vehicles. About one-third reported owning one vehicle, and 40 percent reported owning two vehicles. The more vehicles per household, the greater the number of trips made, with 3.3 trips recorded by households with zero vehicles and 11.8 trips per household for those with two vehicles. Vehicle ownership varied significantly among the eight counties in the region. The highest rates of vehicle ownership per household were in Monroe (2.21), Franklin (2.18), Jefferson (1.98) and St. Charles (1.96) Counties. The lowest rate was found in the city of St. Louis (1.09).

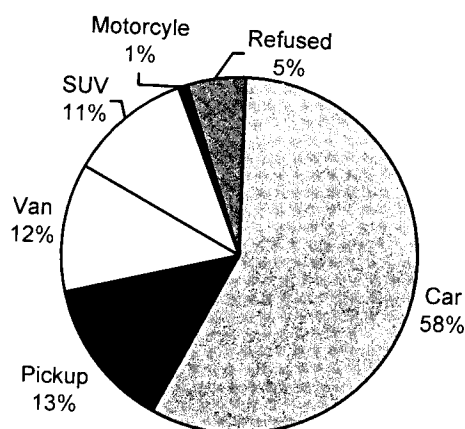
TABLE 17: HOUSEHOLDS AND TRIPS BY VEHICLE OWNERSHIP

Vehicles	#HHs	Percent	# Trips	Percent	Trips/HH
0	89,144	9.2	298,426	3.2	3.35
1	336,178	34.7	2,249,632	23.8	6.69
2	384,201	39.7	4,551,344	48.1	11.85
3	118,173	12.2	1,684,189	17.8	14.25
4	30,789	3.2	490,201	5.2	15.92
5+	10,077	1.0	183,502	1.9	18.21
Total	968,533	100.0	9,457,293	100.0	9.96

Base: 5,094 Households in the St. Louis region, weighted by geography, household size, and vehicle ownership and expanded to represent all 968,533 households in the St. Louis region.

Most vehicles in the region were described as cars (58 percent), with 13 percent described as pickups and 12 percent as vans. About one in ten vehicles (11 percent) was an SUV.

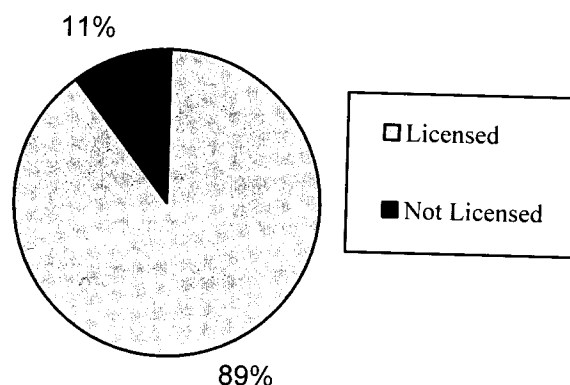
FIGURE 34: VEHICLE BODY TYPES



Base: 10,219 Vehicles in the St. Louis region, weighted by geography, household size, and vehicle ownership and expanded to represent all 1,637,553 vehicles in the St. Louis region.

Most persons age 16 and older (89 percent) were licensed drivers. On average, licensed drivers made 4.4 trips on their assigned travel day, compared to 1.9 trips for unlicensed drivers. About one-third (35 percent) of those who were unlicensed were age 65 and older; 31 percent were between the ages of 16 and 24. Most unlicensed drivers (76 percent) were unemployed.

FIGURE 34: DISTRIBUTION OF LICENSED DRIVERS

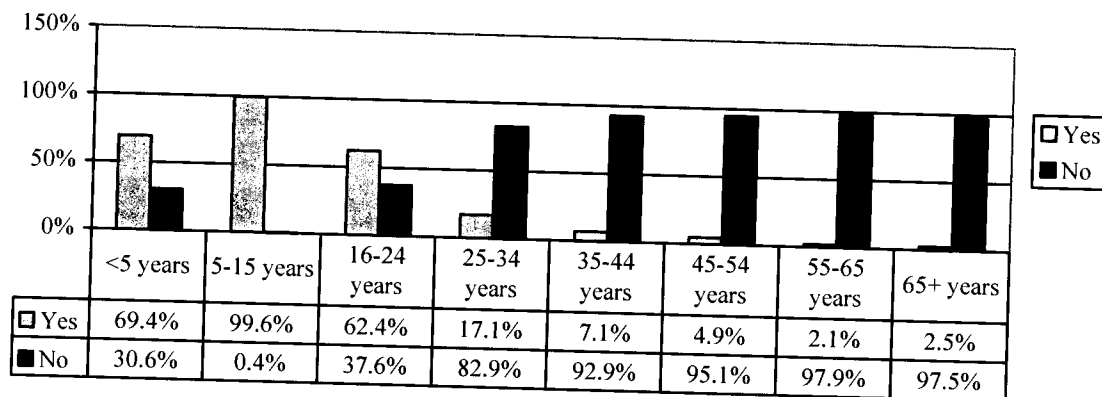


Base: 9,692 persons age 15 and older, weighted by geography, household size, and vehicle ownership to represent 1,840,824 persons in the St. Louis region.

SCHOOL ATTENDEES

About one-third of the sample (33 percent) said that they were attending school. Most of these persons were less than 24 years old. Still, a fairly sizable portion (17 percent) of young adults (ages 25-34) was a student. Adults in school made more trips on their travel day than did non-students. Among young adults (ages 25-34), those in school made 4.2 daily trips compared to 4.0 trips for non-students.

FIGURE 35: DISTRIBUTIONS OF PERSONS ENROLLED IN SCHOOL BY AGE

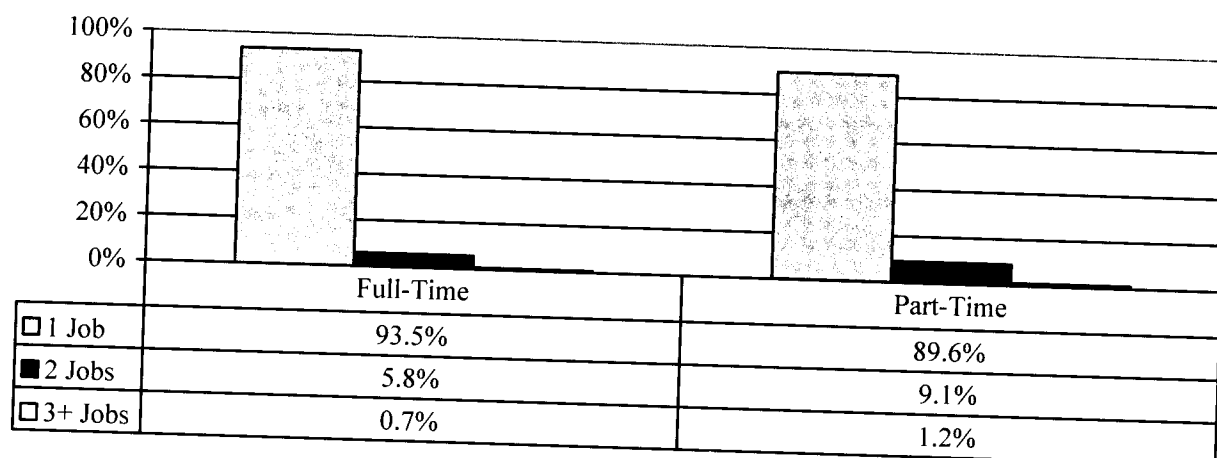


Base: 11,490 persons, weighted by geography, household size, and vehicle ownership to represent all 2,428,730 persons in the St. Louis region.

EMPLOYMENT

Two-thirds of adults, aged 16 years and older, were employed either full- or part-time, representing 1,173,772 persons in the St. Louis region. Among employed persons, most (84 percent) were employed full-time. These persons worked an average of 41.2 hours per week. Only a small number of persons (seven percent) held more than one job. Most of the persons who held more than one job worked part-time.

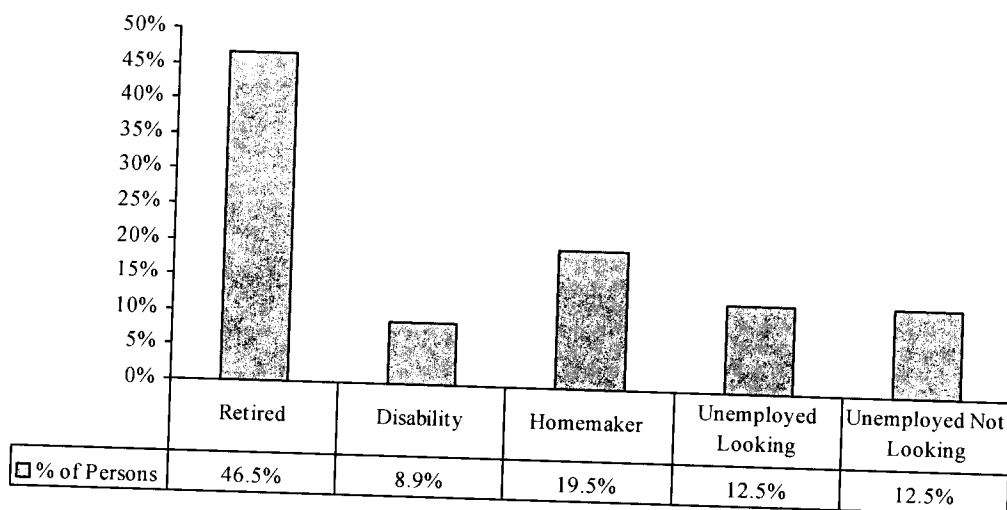
FIGURE 36: NUMBER OF JOBS AMONG EMPLOYED PERSONS



Base: 6,513 persons, weighted by geography, household size, and vehicle ownership to represent 1,173,772 persons in the St. Louis region.

Thirty-six percent of the sample (age 16 and older) was unemployed, representing approximately 667,518 persons. Most of the unemployed individuals were retired (46 percent) or homemakers (19 percent).

FIGURE 37: STATUS OF UNEMPLOYED PERSONS



Base: 3,180 non-employed persons, weighted by geography, household size, and vehicle ownership to represent 667,518 persons in the St. Louis region.

Employed persons made a total of 5,210,186 trips on their assigned travel day. They reported more trips than non-employed persons, with the exception of homemakers. In fact, homemakers reported the most trips at 4.8 trips per person. Disabled persons reported the fewest trips, on average.

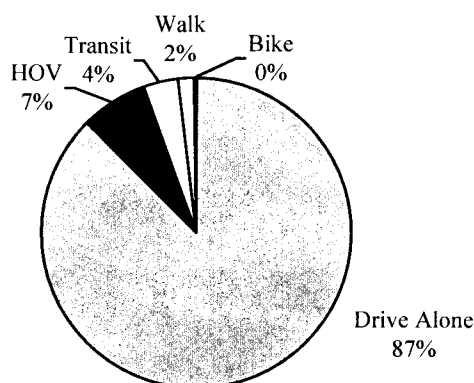
TABLE 20: PERSONS AND TRIPS BY EMPLOYMENT STATUS

Employment Status	# Persons	Percent	# Trips	Percent	Trips/Person
Employed	1,173,772	63.8	5,210,186	68.5	4.44
Not Employed, Retired	310,396	16.9	1,038,093	13.7	3.34
Not Employed, Disabled	59,742	3.2	139,658	1.8	2.35
Not Employed, Homemaker	130,012	7.1	627,757	8.3	4.83
Not Employed, Looking for Work	82,854	4.5	303,339	4.0	3.66
Not Employed, Not looking for Work	83,705	4.5	284,459	3.7	3.40
Total	1,804,481	100.0	7,603,492	100.0	4.0

Base: 6,513 persons, weighted by geography, household size, and vehicle ownership to represent 1,173,772 persons in the St. Louis region.

Employed persons were asked their "usual" mode to their main job; other mode information in this report provides data on mode to work on the assigned travel day. Most persons (87 percent) in the St. Louis region usually drive alone to work; 7 percent ride share; 4 percent use transit; and 2 percent walk. Less than 1 percent usually bike to work.

FIGURE 38: USUAL MODE TO MAIN JOB



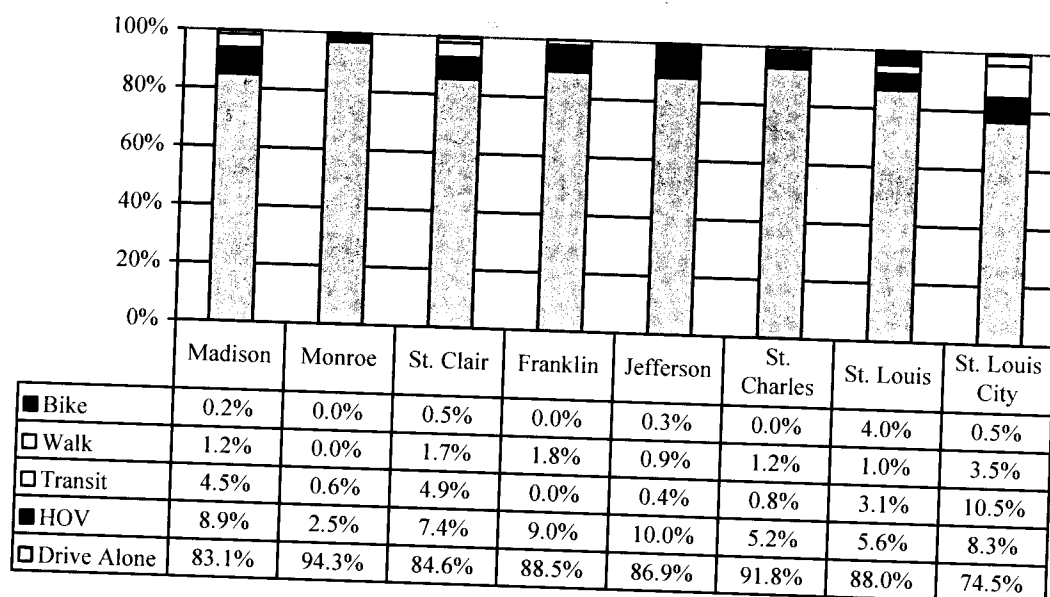
Base: 6,513 persons, weighted by geography, household size, and vehicle ownership to represent 1,173,772 persons in the St. Louis region. Excludes "missing."

Most employed persons (89 percent) have free parking at their main job. Of those that do not, 17 percent reported that their employer paid for the parking, and 94 percent of those used the employer-paid parking¹⁵. Fewer employed persons (4 percent) reported that they received a transit subsidy from their employer, and less than half (43 percent) said they used the employer-provided transit subsidy.

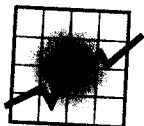
Employed persons usual mode to work varied by their county of residence. Persons in Monroe and St. Charles Counties were the most wedded to driving alone, with 94 percent and 92 percent reporting usually driving alone, respectively. Employed persons in the city of St. Louis were the most diverse in their mode choice. With nearly 11 percent using transit and 3 percent walking, in addition to 74 percent driving alone and 8 percent sharing rides.

¹⁵ Some respondents reported their employee-paid parking as free parking.

FIGURE 39: USUAL MODE TO MAIN JOB BY COUNTY OF RESIDENCE



Base: 6,513 persons, weighted by geography, household size, and vehicle ownership to represent 1,173,772 persons in the St. Louis region. Excludes "missing."



GPS SURVEY RESULTS

Trip underreporting has long been a problem in household travel surveys due to the self-reporting nature of traditional diary survey methods. Memory decay, failure to understand or follow survey instruction, unwillingness to report full details of travel, and simple carelessness have all contributed to the incomplete collection of travel data in these self-reporting surveys. While the trip rates reported by households in the St. Louis region were higher than those reported in other recent household travel surveys, the GPS survey results nonetheless were insightful and useful. Results indicated under-reporting at levels that were considerably less than that found in other household travel surveys.

DEPLOYMENT RESULTS

The GPS study was conducted over a ten-week period between September 5th and November 7th, 2002. Within this time period, 455 households were recruited into the GPS portion of the main household travel study. Of these 455 households, 313 received GPS equipment. The remaining recruited households received a 'Thank You' postcard that explained that they were not needed as a participant in the GPS portion of the study but that their diary data would still be collected.

Vehicle Completion

Equipment packages for 666 vehicles were hand-delivered to 313 households over the course of the study. Each household was given equipment for up to three household vehicles. A total of 428 vehicles from 250 households successfully returned GPS data and had CATI trip data reported. Of these 428 vehicles, 108 recorded no travel and had no travel reported.

Household Completion

For the household-level analysis in this report, only households in which all vehicles (up to three) had both CATI and GPS data will be used in discussions on trip correction factors. GeoStats and NuStats are currently developing regression models for the appropriate application of correction factors; these models will be expanded to include results of data collected in partially complete households.

Of the 313 households that were deployed, 279 successfully completed the CATI portion of the study and 176 successfully completed the GPS portion of the study. GeoStats analysts have found a total of 150 of the 313 deployed households (48 percent) to be complete for the GPS to CATI comparison analysis. Of the 150 complete households, five households did not travel on their assigned travel day.

The other 163 households did not complete all parts of the study or had data anomalies that could not be resolved. These households have been categorized as partials (100 households) or refusals (63 households) and are reviewed in the following section.

Partially Completed Households

A household was classified as a partial household if they had one or more vehicles with useable CATI and GPS data, but other vehicles in the household that either refused the GPS unit, forgot to use it, had a broken cigarette lighter, or traveled with their GPS unit on a day different than their scheduled travel day. Although these data could be used in a trip rate analysis, they have not been included in the analysis contained in this report. Table 21 shows the current completion breakdown of the deployed households.

TABLE 21: COMPLETION BREAKDOWN OF DEPLOYED GPS HOUSEHOLDS

Completes	Partial	Refusals	Total
150	100	63	313

Refusal Households

A refusal household was one for which no comparative analysis could be made due to either a total lack of useable GPS data or useable CATI data for all vehicles in the household.

TRIP COMPARISONS

Once the GPS and CATI data from the 150 completed households in the St. Louis Regional Travel and Congestion Survey were received, a total of 1383 GPS trips were identified based on processing of the GPS trip data within the interactive GIS application. The CATI trip file generated a total of 1,243 trips for the same households' vehicles.

Next, the CATI-reported trips for each vehicle in each household were compared with the GPS-derived trip data. This comparison was performed automatically via a program designed to compare individual trip records in each vehicle file using only the departure time as the significant variable for matching. A match rate of 57.9 percent was attained for all GPS measured trips using a plus or minus 12.5-minute departure time buffer as the only match criteria. Using the CATI reported trips as the baseline, 64.4 percent of the CATI trips were automatically matched to a GPS trip using this process.

The results of the matching process for each vehicle were then reviewed and analyzed, with matching corrections made based on the type of discrepancy found. A final match rate of 81.9 percent for all GPS measured trips was achieved upon completion of the review process. Using the CATI reported trips as the baseline, 91.1 percent of the CATI trips were successfully matched to GPS trips upon completion of this review.

Matching results and discrepancies fell into the following categories:

- 1) Matched Trips
 - a) Trips detected and reported (i.e., a correct match)
 - b) Trips detected but reported with poor accuracy in trip start time, resulting in either:
- 2) Trips detected but not reported (i.e., underreported or missed trips)
- 3) Trips not detected but reported

Category 1a: Exact Matches

For these households, all reported trip start times fell within plus or minus 12.5 minutes of the recorded GPS departure times for each vehicle. Therefore, it is very likely that these respondents were very committed to recording and reporting their trip times very accurately. Further analysis of these matched trips revealed that the geographic locations of the individual trip ends were also sufficiently close and thus confirm the match assignment.

Of all trips made by the 300 vehicles being analyzed as part of the completed households, 58 vehicles had perfect matches of GPS-detected and CATI-reported trips without any corrections needed. Once the manual review process was complete, another 66 vehicles were perfectly matched. In addition to these,

73 vehicles had no trips recorded or reported on their travel day, which is also considered an exact match. Overall, 197 of the 300 vehicles (65.7 percent) had a perfect GPS trip match with data reported in their CATI interview. Example maps and screens for a vehicle that had perfect matches between GPS-measured and CATI-reported trips can be seen in Appendix A.

Category 1b: Trips Detected but Reported with Poor Trip Start Time

In these cases, it seemed apparent that the respondents failed to record, report, or remember one or more trip departure times correctly. As a result, the matching process would either result in an unmatched trip (where the CATI-reported and GPS-measured trip start times were more than 12.5 minutes apart) or in a mismatched trip (where a sequence of CATI and GPS trips were offset significantly, yet the matching algorithm caused a match on incorrect trip pairs). For both types of matching discrepancies caused by poor reporting of trip times, matching corrections were applied based on trip end locations and the GPS and CATI trips were ultimately matched.

Category 2: Trip Detected but Not Reported

As suspected and targeted as the study objective, there were trips detected by the GPS data loggers that were not reported by the respondent. These 'missed trips' were initially tagged as either single links missed within a trip chain, multiple links missed within a trip chain, or as complete round-trips missing all links in tour (which could be two or more).

In this study, a total of 1243 trips were reported via CATI; after the comparisons were complete, a total of 140 trips were detected within the GPS data that were not reported by respondents. A total of 66 households (44 percent of 150 households) recorded at least one GPS trip that was not reported within their diary data.

Category 3: Trip Not Detected but Reported

In a few cases, trips were reported that had no corresponding GPS data. These occurrences fell into three categories: 1) first trips of the day; 2) last trips of the day; or 3) trips that are not first or last trips of the day.

Of the 150 complete households, 39 households were identified as having a least one missed GPS trip. A total of 111 missing GPS trips were identified and classified as one of three possible missed GPS trip types – initial trip(s) of day, mid-day trips, or end of day trips. It is suspected that a vast majority of start-of-day missed GPS trips are due to a lack of power to the GeoLogger resulting from delayed installation. In addition, it is highly likely that the end-of-day missed GPS trips are the result of GeoLogger removal followed by unplanned, end-of-day errands. To explain missing mid-day GPS trips, further research is underway. These could have resulted from a misreporting of vehicle identification in the CATI retrieval script, a loss of signal in the middle of the day, or if the respondent removed the device for some reason (i.e., to use the cigarette lighter to power a cell phone or to light a cigarette).

TRIP COMPARISON RESULTS

A summary of the results of the trip comparison and review processes for the 150 complete households, broken down by county, can be seen in Table 22. This table shows the number of complete households (# hh) for each county, the number of vehicles instrumented in these households (# veh), the total number of GPS-identified trips after the review process for all instrumented vehicles (GPS trips); the total number of CATI-retrieved trips associated with all household vehicles (CATI trips); the number of missed trips detected (#Missed Trips), for which a baseline measure has been calculated as simply the difference

between the total number of GPS-detected trips and the total number of CATI-reported trips, and the percentage of missed CATI trips.

As mentioned earlier in the analysis of trip comparisons, there were also missing GPS trips that clearly should have been logged, but for some reason (such as operator error) were not captured. The number of undetected or missed GPS trips by county (for start-of-day and end-of-day missed GPS trips only, assuming that the GeoLogger was installed after the first trip or removed prior to the last trip of the travel day) is also shown in Table 22, along with the adjusted total missed trips and adjusted percentage of missed CATI trips.

TABLE 22: SUMMARY OF TRIP COMPARISONS BY COUNTY

County	# HH	# Veh	GPS Trips	CATI Trips	Missed Trips	Percent Missed	Missed GPS Trips	Missed Trips (adjusted)	Percent Missed (adjusted)
Franklin County, MO	10	23	102	102	0	0.0%	11	11	10.8%
Jefferson County, MO	10	23	103	83	20	24.1%	9	29	34.9%
Madison County, IL	19	37	253	213	40	18.8%	3	43	20.2%
Monroe County, IL	4	8	17	18	-1	NA	1	0	0.0%
St. Charles County, MO	12	23	93	96	-3	NA	12	9	9.4%
St. Claire County, IL	18	38	192	156	36	23.1%	6	42	26.9%
St. Louis City, MO	11	18	81	57	24	42.1%	5	29	50.9%
St. Louis County, MO	66	130	542	518	24	4.6%	27	51	9.8%
TOTAL	150	300	1383	1243	140	11.3%	74	214	17.2%

Overall, there were 1383 GPS trips detected and 1,243 trips reported across the 300 vehicles instrumented in this study. This 140 trip reported shortfall is equivalent to 11.3 percent of the reported trips.

When the missed GPS trip count is included for start and end of day trips only, the shortfall increases to 214 trips or a 17.2 percent underreporting rate. Finally, for these 150 households, the average household vehicle trip rate for all vehicle trips on the assigned travel day and measured by GPS is 9.2 and increases to 10.6 trips if the missed GPS trips are included; the equivalent CATI-reported vehicle trip rate is 8.3.

TRIP CORRECTION FACTORS AND APPLICATION: NEXT STEPS

When investigating how to apply trip correction factors to the data, it is important to note that different types of characteristics contribute at different levels to underreporting rates. This section discusses some of the characteristics that are currently being explored.

Trip underreporting has person-level and household-level contributors. Some households as a whole show underreporting activity while some households' underreporting can be attributed to only one person. It is possible that proxy reporting and lack of diary use contribute to underreporting.

Ten key variables associated with each trip have been analyzed (Trip Duration, Distance, Household Size, Vehicle Ownership, Household Income, Respondent Age, Employment Status, Student Status – student or not, multiple activities – work and school, two or more jobs, and presence of children under 18). A multivariate regression technique (Logistic Regression) was used to determine which variables had the most impact on trip under reporting.

Four were identified as having significant influence on trip under reporting while the remaining six variables were insignificant. The variables that were identified as contributing most to trip under reporting are Trip Duration, Vehicle Ownership, Household Income, and Age of Respondent.

For example, Table 23 shows the missed trip analysis based on the number of household vehicles that were instrumented in the study. As expected, those households with the most vehicles revealed the highest levels of underreporting.

TABLE 23: TRIP COMPARISON BY NUMBER OF VEHICLES

NUMBER OF VEHICLES	HOUSEHOLDS	GPS TRIPS	CATI TRIPS	MISSED TRIPS	PERCENT MISSED	GPS MISSED	MISSED TRIPS (ADJUSTED)	% MISSED (ADJUSTED)
1	40	264	226	38	16.8%	5	43	19.0%
2	71	605	588	17	2.9%	46	63	10.7%
3	39	514	429	85	19.8%	23	108	25.2%
TOTAL	150	1383	1243	140	11.3%	74	214	17.2%

FIGURE 40: EXAMPLE SCREEN AND MAP FOR PERFECT MATCH OF GPS-MEASURED AND CATI REPORTED TRIPS

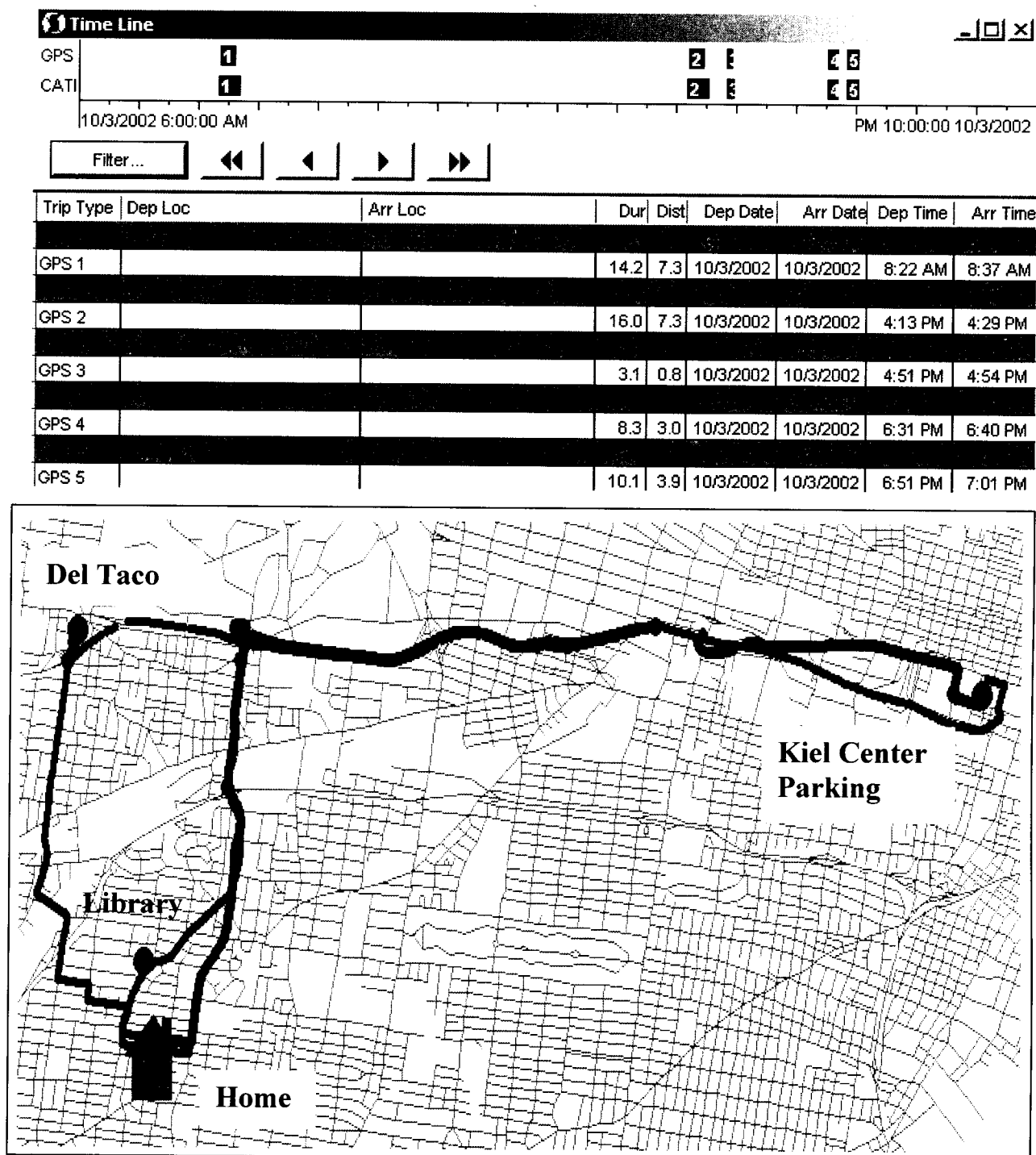
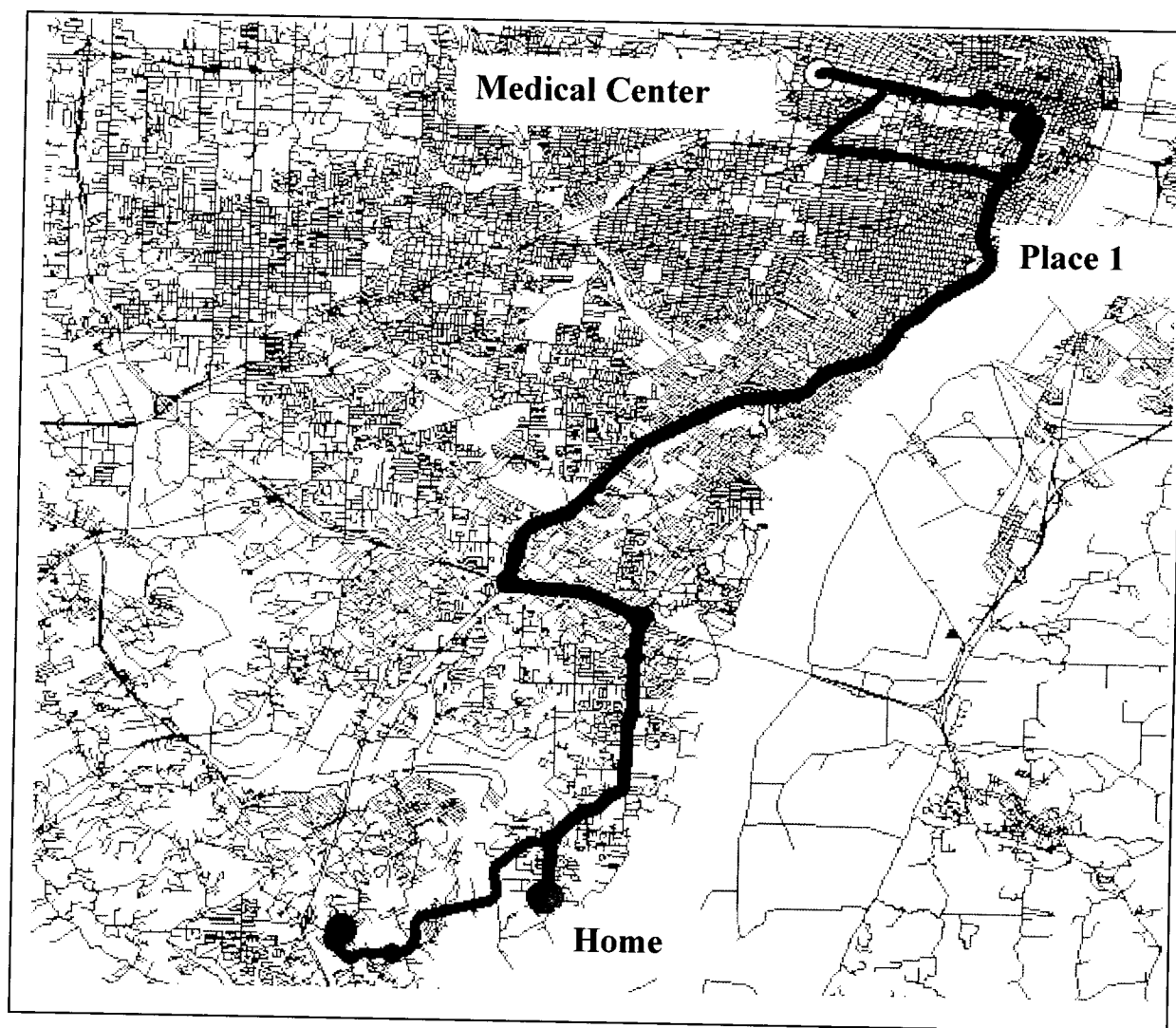


FIGURE 41: EXAMPLE MAP AND SCREEN OF GPS-DETECTED AND CATI UNREPORTED TRIP



Time Line

GPS ☐ 1
CATI ☐ 1

9/27/2002 5:06:37 AM PM 4:24:23 9/27/2002

Filter... ◀◀ ▶▶ ▶▶ ▶▶

Trip Type	Dep Loc	Arr Loc	Dur	Dist	Dep Date	Arr Date	Dep Time	Arr Time	Match Status
GPS 1			23.0	19.7	9/27/2002	9/27/2002	5:06 AM	5:29 AM	MATCH_BY_USER
GPS 2			8.9	3.3	9/27/2002	9/27/2002	2:35 PM	2:44 PM	MATCH_BY_TIME
GPS 3			33.9	23.7	9/27/2002	9/27/2002	2:48 PM	3:22 PM	MATCH_BY_TIME
GPS 4			10.5	6.0	9/27/2002	9/27/2002	3:51 PM	4:02 PM	MISSING_ALL_LINKS_IN_ROUND_TRIP
GPS 5			11.2	6.2	9/27/2002	9/27/2002	4:13 PM	4:24 PM	MISSING_ALL_LINKS_IN_ROUND_TRIP

Notes – Final 2 trips of the day are unreported. (Round trip from home)