Program Summary

Background

The MI Travel Counts program was undertaken by the Michigan Department of Transportation (MDOT) and its partners to obtain information on statewide household travel characteristics. MDOT will use the data to update, develop, and calibrate statewide and urban travel demand models. The primary use of the models is to estimate future travel demand and travel patterns in determining project requirements and investment priorities for the State Long Range Plan, the shorter term Statewide Transportation Improvement Program (STIP), local Metropolitan Planning Organization (MPO) Long Range Plans (LRP), and the MPO Transportation Improvement Plans (TIP). Other uses include air quality conformity, alternatives analysis, and detour analysis.

MI Travel Counts is significant in its endeavor. There has never been a household travel data collection effort for the entire state. MDOT has not collected travel characteristics in urban areas since the 1970s. The only recent data collection effort in Michigan was conducted by Southeast Michigan Council of Governments (SEMCOG) in 1994.

In the design of MI Travel Counts, basic demographics and tour and travel characteristics were collected for every member (including children) of 14,315 households during a consecutive 48-hour travel period. MDOT and the MI Travel Counts consulting team developed and implemented eight key program and quality control components:

- Sample Design (Appendix 1)
- Work Plan and Data Collection Methodology (Appendices 2 and 3)
- Design of Materials and Instruments (Appendices 4-17)
- Public Awareness Plan (Appendices 18-21)
- Geocoding Procedures Manual (Appendix 22)
- Data Coding and Quality Control Manual and Codebook (Appendices 23 and 24)
- Pilot Study Report (Appendix 25)
- Interim Report and Data Delivery Schedule and Report Format (Appendices 26 and 27)

Development, testing, agreement, and follow-through on these eight program components were considered essential to the quality of data collection that would support the modeling efforts of MDOT.

All eight of these components are described in full in the following sections and appendices.

Sample Design

The sample design for MI Travel Counts divided the State of Michigan into seven geographic sample areas. Each sample area is defined by a collection of counties or other entities that are either geographically contiguous or similar, with respect to the types of travel patterns and behaviors generated by households within those "sampling areas". The seven sample areas were the following:

1. SEMCOG (Seven counties of Detroit Area)
2. Small Cities (Population of 5,000-50,000 outside small urban and TMA areas)
3. Upper Peninsula Rural
4. Northern Lower Peninsula Rural
5. Southern Lower Peninsula Rural
6. Transportation Management Areas (TMAs) (Population over 200,000)
7. Small Urban Modeled Areas (Population between 50,000-200,000)

The MI Travel Counts Sampling Plan Technical Document is attached as Appendix 1; a map of the sampling areas is provided in Section 4.

To ensure nearly equal precision on data calculations within each area and when comparing across areas, the sample design required a minimum of 2,040 completed and accepted households within each of the seven sampling areas.[1]

Within sampling areas, the modeling rationale for the sample design was that auto sufficiency (the degree to which the number of autos available to a household matches the number of workers in the household), rather than auto ownership and household size is more highly correlated to travel behavior. While traditional household travel sampling designs rely on classification by household size and number of autos (or income), MI Travel Counts added an additional variable of interest—number of workers in the household to the sample design.

The stratification of households by household size, autos available, and number of workers identified 64 potential cells per geographic area (4 x 4 x 4). Upon inspection, improbable cells were removed from the tables where the number of workers was greater than household size. The first aggregation combined the cells where auto ownership was greater than the household size.

The next aggregation was to combine cells, having fewer than 30 households, within auto sufficiency categories. There are four levels of auto sufficiency: no autos, autos less than workers, autos greater than workers, and autos equal to workers. The first pass was to aggregate within auto sufficiency categories and household size. This was sufficient except for the zero auto households, which needed to be aggregated across household size. This is due to the rarity of zero-auto households outside of one-person households.

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[1] Household with 5+ persons were considered complete if acceptable travel inventories were received from all but one member.

This stratification and re-aggregation process resulted in 169 data cell quotas across the seven sample areas. The target households were increased to 30 for those cells that proportionally had less than 30 households. The summary number of households by sample area for MI Travel Counts is shown in Table 1.

Table 1. Summary of Households by Sample Area for MI Travel Counts

Sample Area	Targeted Households	Retrieved Households	Accepted Households
SEMCOG	2,040	2,539	2,249
Small Cities	2,044	2,760	2,369
Upper Peninsula Rural	2,051	2,306	2,044
Northern Lower Peninsula	2,054	2,353	2,090
Southern Lower Peninsula	2,043	2,258	2,084
TMAs	2,041	2,315	2,098
Small Urban Modeled Areas	2,042	2,222	2,062
Total	14,315	16,753	14,996

Note: 16,753 households were actually completed. By definition, a completed household was a household where two-day travel inventories and related information had been retrieved from every member. An accepted household, by definition, is a household that after thorough audit and review, the household's information was accepted by MDOT. The completed and accepted number of households may not be the same, as some households, for various reasons, were rejected by MDOT.

The design resulted in some data cell quotas for rare population households such as 2+ persons with zero autos in rural areas and 4+ person households with fewer autos than workers. For the most part, rare population households were also in the low-income category. Collecting travel inventories from these households proved challenging since early data analysis showed that even when these households were successfully recruited, they completed travel inventories at lower rates than more typical households (such as 2-person households with two autos and two workers).

In order to complete these rare population data cell quotas, MI Travel Counts implemented five responsive interviewing design[2] strategies over the course of the data collection period. Each of these strategies used a series of different or successive recruitment and response techniques. These modifications included:

- Adjusting recruitment sample targets based on the varying actual retrieval rates for different data cells.
- Introducing portions of low-income targeted Random-Digit-Dial (RDD) samples into the traditional RDD sampling frames.

[2] Steven Heeringa and Robert Groves, *"Responsive Design for Household Surveys"* in the 2004 Proceedings of the American Statistical Association, Survey Research Methods.

- Introducing differential incentives ($20-$30 [not paid for by MDOT]) for zero-vehicle households and households with fewer autos than workers, if all members of the household completed the travel inventories.
- Introducing RDD listed sample targeted by income and household size.
- Conducting refusal conversion interviews for all households recruited in rare population data cells that did not initially complete the travel inventories (retrievals).

The detailed sequencing and corresponding results of these modifications by phase is described in Section 8 of this report.

The final outcomes for MI Travel Counts were as follows:

14,996 households with a total of 37,475 persons were completed and accepted. However, 14% of the data cells were short of targeted household goals, by a total of 211 households spread across 24 cells. All sample areas met the minimum target of 2,040 households.

The 211 households short of specific targeted data cell goals were spread over 24 of the 169 data cell quotas. These data cells included households with 2+ persons and zero autos in the three rural sampling areas, 3+ person households with autos (more than zero) but less than workers in two sampling areas, and 4+ person households with the same number of autos and workers in five sampling areas including SEMCOG. All of these data cells represent rare populations (less than 5% of the household distribution), which are largely low income. These households proved difficult to reach by RDD phone methods since they are likely to be concentrated in small geographic areas or housing complexes and some may not have phones. Differential response rate analysis showed that they also are less likely to participate fully once recruited.

In terms of overall MI Travel Counts response rates, based on the American Association for Public Opinion Research's (AAPOR) Response Rate 3 (RR3) calculation method, the overall recruitment response rate for MI Travel Counts was 48.6%. The participation rate (retrievals/recruitments) overall was 57.6%. In comparison, the respective response rates for the 2001 National Household Travel Survey (NHTS) were 56.2% for the recruitment and 59.3% for the participation rate. The Council of American Survey Organizations (CASRO) method was used as the basis for calculating response rates for NHTS, which included ineligible pre-screened numbers (numbers removed as non-working from the RRD sample by the sample generating company, Genesys, before the sample was sent to data collection firms). Therefore, a direct comparison of the recruitment response rate cannot be made since MI Travel Counts did not include ineligible pre-screened numbers. Exclusion of the ineligible pre-screened numbers in the MI Travel Counts automatically lowers the recruitment

response rate. However, the participation rate can be compared and is within 1.7% of the NHTS.

Work Plan and Data Collection Methodology

In the first three months of MI Travel Counts, extensive time was spent by MDOT and its partners developing a detailed work plan and delivery schedule for all facets of the data collection program. This program included the initial, interim, and final drafts of all required materials and manuals. The pilot and pilot report were scheduled as well as start-up of data collection and delivery of interim reports, after the completion of each 2,000 households. The delivery schedule was adhered to throughout the program. An exception was the delivery of the last set of completed households due to adjustments made at the end of interviewing to implement special methods to retrieve the rare population households.

In addition to a detailed Work Plan, a Data Collection Methodology Plan was developed that provided an overall blueprint for the MI Travel Counts data collection effort. The Data Collection Methodology Plan included protocols for recruitment of households and retrieval of travel inventories, with specific references to the Sampling Plan Document, Data Coding and Quality Control Manual, and the Geocoding Procedures Manual. These protocols defined criteria for determining whether a completed household would be accepted. All documents were approved prior to use in the Pilot by MDOT.

Additionally, the MI Travel Counts Data Collection Methodology Plan defined procedures for the long distance trip retrospective data collection component for each household member as well as for collection of travel inventories from any visitors staying overnight at a respondent household, within the 48-hour travel-recording period. The information from visitors to a household was included in order to capture travel characteristics from tourists, within and outside Michigan, who are staying overnight at residences rather than at hotels and motels.

Design of Materials and Instruments

The first four months of MI Travel Counts were also devoted to development of data collection materials and instruments. Subcommittees of MDOT staff, primary personnel from MORPACE, PBConsult, RLN Transportation Planning, Brogan & Partners, and international expert Peter Stopher, Ph.D., were involved in this task. There were a minimum of three iterations and reviews of each item before final drafts were approved.

In order to reduce respondent burden, particular attention was paid to the diary format to ensure that all modeling data requirements were met and that the flow and construction of questions and instructions were clear. The following materials and instruments can be found in the Appendices as cited below:

Final Pre-Recruitment Letter	Appendix 4
Person Information Sheet	Appendix 5

Diary Cover Letter	Appendix 6
Diary Labels	Appendix 7
Diary (Without Person Sheet)	Appendix 8
Final Diary with Person Sheet	Appendix 9
Reminder Call Script	Appendix 10
Initial Recruitment Script	Appendix 11
Recruitment Script after June 2, 2004	Appendix 12
Final Retrieval Script	Appendix 13
Summer Postcard	Appendix 14
Incentive Postcard	Appendix 15
Incentive Letter	Appendix 16
Retrieval Postcard	Appendix 17

Section 5 of this report fully describes the design of MI Travel Counts data methodology plans, instruments, and procedures.

Public Awareness Plan and Program

The public awareness plan and program were designed and carried out by Detroit-based public relations firm Brogan & Partners in cooperation with MDOT, and consisted of six key elements:

- Development of a name and logo for the data collection program that would be immediately identifiable as to the project's intent and legitimacy.
- Pre-notification letters to legislators and affected state, regional, and local planning and transportation officials.
- Press releases to the media.
- A MI Travel Counts website (www.michigan.gov/mitravelcounts).
- A 1-800 number manned by MORPACE's phone room for respondent questions and follow-up.
- The phone number of the MDOT project director provided in the pre-recruitment letters and the diary cover letter for questions and concerns.

The Public Awareness Plan is described in Section 5 of this report.

The website had an average of 573 hits per month. The 1-800 number had a range of 2,000 to 4,000 calls per month over the data collection period, slightly higher than other recent travel inventory projects. The MI Travel Counts program received several positive news coverage spots on Michigan TV and radio stations and articles in the metropolitan Detroit and local newspapers. No negative coverage was encountered.

Respondent inquiries were mainly to verify the authenticity of MI Travel Counts, to learn who commissioned the study, and to learn the purpose of the study. Many respondents wanted clarification about the correct way to fill out their travel diaries, or to ask if the study was only for users of public transportation, or to ask if trips made during work needed to be reported. There were a few complaints about the length of the travel diary. The MDOT project director received many of the same

types of calls, which were referred to MORPACE and resolved as quickly as was possible.

Respondents also called for reasons not related to the MDOT study. These included questions about local bus schedules, complaints about road conditions, and to request dial-a-ride pick-ups. Both MORPACE and the MDOT project director responded to these calls.

Geocoding Procedures

A fully detailed manual for geocoding was developed in consultation with MDOT staff. Geocoding was performed on a continuous basis. Address information for all origin and destination points was downloaded continually by MORPACE. The geocoding procedures for MI Travel Counts are fully described in Section 10 of this report.

Table 2 summarizes the MI Travel Counts final geocoding results. The results exceeded or met the standard set in the Geocoding Procedures Manual. The minimum geocoding goal for home addresses and destinations was 99%, 95% for school and work addresses/destinations, and 90% for all trip origins and destinations.

Table 2. Geocoding Results for MI Travel Counts

Household Locations	Minimum Goal %	Total # Households Retrrieved	% of Retrieved Home Addresses Geocoded	Retrieved Home Addresses Not Geocoded % (N)	Total # Households Accepted	% of Accepted Home Addresses Geocoded	Accepted Home Adresses Not Geocoded % (N)
Household Home Address	99%	16,753	99.9%	0.04% (6)	14,996	100%	0% (0)
Person Locations	**Minimum Goal %**	**Total # of Worker/Student Locations Retrieved**	**% of Retrieved Worker/Student Locations Geocoded**	**Retrieved Worker/Student Locations Not Geocoded % (N)**	**Total # of Worker/Student Locations Accepted**	**% of Accepted Worker/Student Locations Geocoded**	**Accepted Worker/Student Locations Not Geocoded % (N)**
Person Primary Work Address	95%	18,927	97.6%	2.4% (453)	16,975	98.5%	1.5% (254)
Person Secondary Work Adddress	95%	898	96.2%	3.8% (34)	814	96.7%	3.3% (27)
Person School Address	95%	10,722	99.2%	0.8% (90)	9,488	99.4%	0.6% (59)
Primary Activity at Destination	**Minimum Goal %**	**Total # Retrieved Destinations**	**% of Retrieved Destinations Geocoded**	**Retrieved Destinations Not Geocoded % (N)**	**Total # Accepted Destinations**	**% of Accepted Destinations Geocoded**	**Accepted Destinations Not Geocoded % (N)**
Home for Paid Work or Other	99%	88,674	99.9%	0.01% (13)	78,728	100.0%	0% (2)
Work	95%	40,881	96.7%	3.3% (1,359)	36,679	98.2%	1.8% (662)
School	95%	19,086	98.8%	1.2% (228)	16,893	99.5%	0.5% (78)
Other Than Work/School	90%	147,283	95.6%	4.4% (6,476)	129,084	97.4%	2.6% (3,379)
Total Destinations	90%	295,924	97.3%	2.7% (8,076)	261,384	98.4%	1.6% (4,121)

For all trip origin and destination points of accepted households, only 1.6% were not geocoded. Only 16.2% of the geocoded points were geocoded to the nearest street intersection rather than to street address.

Data Coding and Quality Control

A full data coding book and quality control procedures were developed in consultation with MDOT staff before the start of the pilot. The quality control plan had four components:

1. Acknowledgement of the ethics and quality measures incumbent upon MORPACE as a member of the Council of American Survey Organizations (CASRO) and as a registered International Standards Organization 9000-200 firm.
2. Reliance on MORPACE's customized in-house Computer-Assisted Telephone Interviewing (CATI) system programmed logic checks and features.
3. A series of post-processing data checks performed by both MORPACE , PB and MDOT staff on an interim delivery basis.
4. Interim audit reviews of data by MORPACE, PB, and MDOT upon completion of the pilot, 2,000, 4,000, 6,000, 8,000, 10,000, 12,000, and 14,280, 16,000, 16,700, and 16,753 households.

Data quality control procedures and results are summarized in Section 11 of this report.

Pilot Study

The purpose of the pilot was to test the performance of the draft MI Travel Counts materials and procedures. Sixteen data collection instruments, procedures, and protocols for collecting the desired activity and travel data were tested and full retrieval interviews were conducted with all members of 126 households.

The pilot was considered successful. There were several changes that were made as a result of the pilot, which showed the value of the pilot survey process. The pilot helped to refine the final procedures and instruments and paved the way for a high quality program. The design and results of the pilot are summarized in Section 6 of this report.

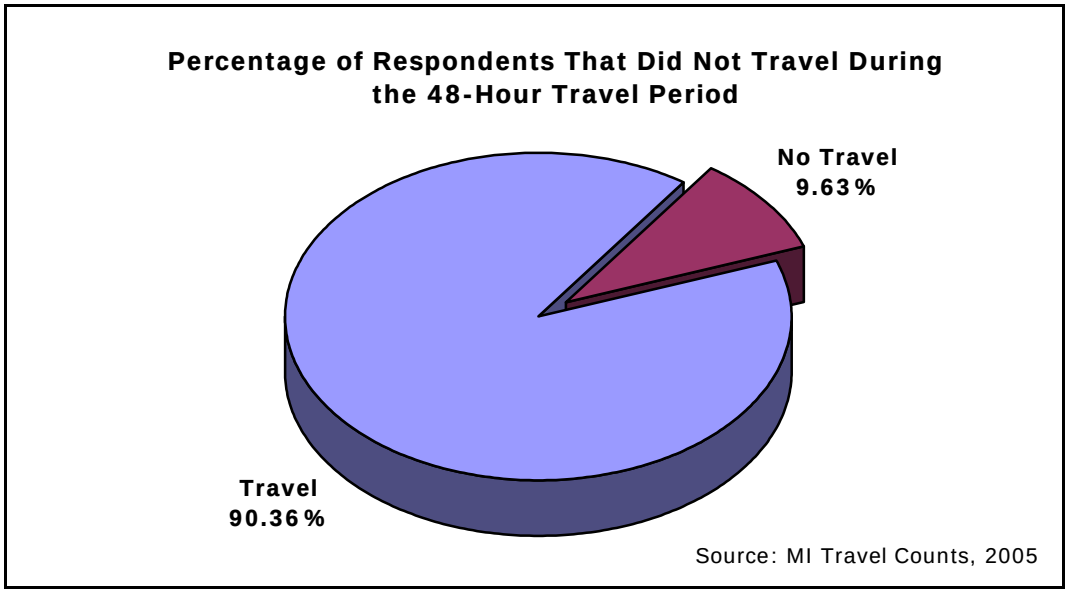
Interim Report and Data Delivery Formats and Schedule

A final element of the MI Travel Counts program was the interim delivery and review of data after the pilot, and at intervals of 2,000, 4,000, 6,000, 8,000, 10,000, 12,000, 14,280, 16,000, 16,700, and 16,753 household completions. At each of these intervals the interim datasets were reviewed and checked by MORPACE, and audited and reviewed by both PB and MDOT. Households, persons, or trips with missing or inconsistent data were flagged for further review and consideration of their acceptability.

Data Results

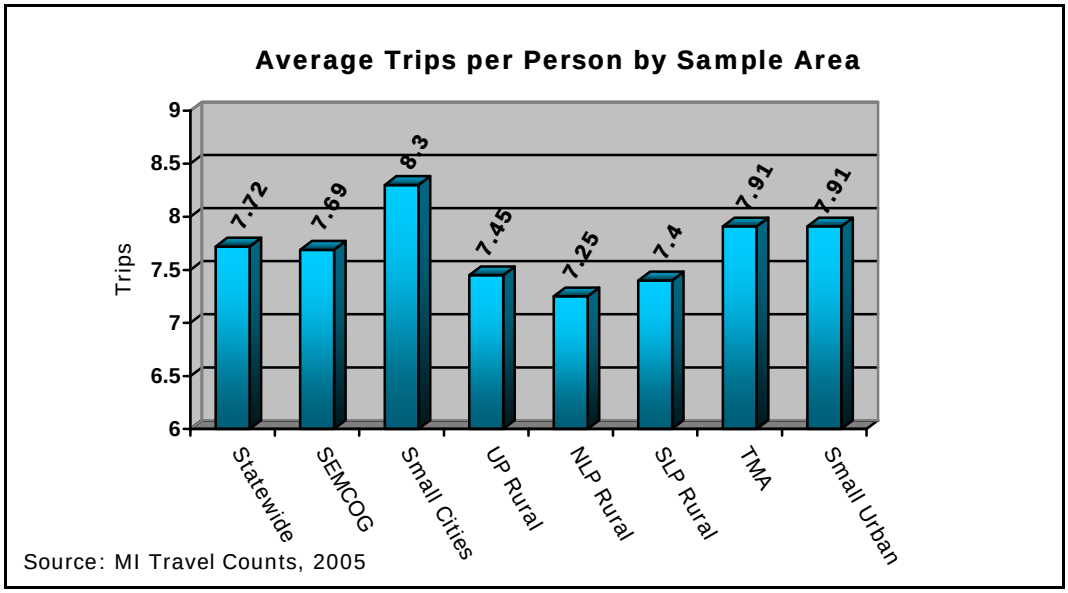
Figures 1 through 9 highlight travel characteristics for the 14,996 households that were completed and accepted by the MI Travel Counts data collection program.

Figure 1: Percentage of Respondents That Did Not Travel During the 48-Hour Travel Period



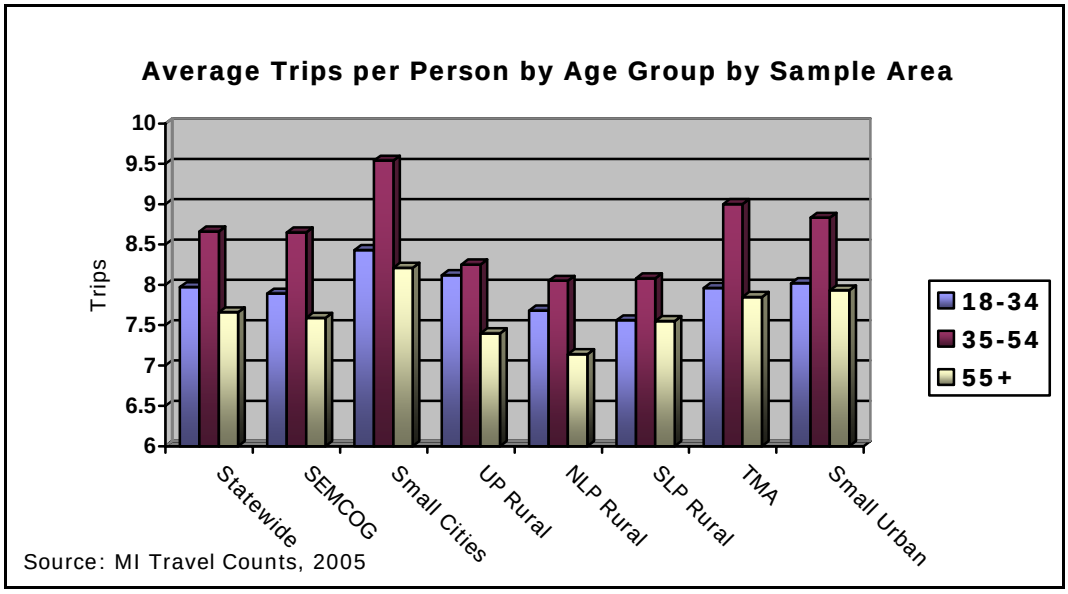
- *Figure 1:* (Unweighted) Less than 10% of respondents did not travel during the 48-hour assigned travel period.

Figure 2: Average Trips per Person by Sample Area (48 Hour Travel Period)



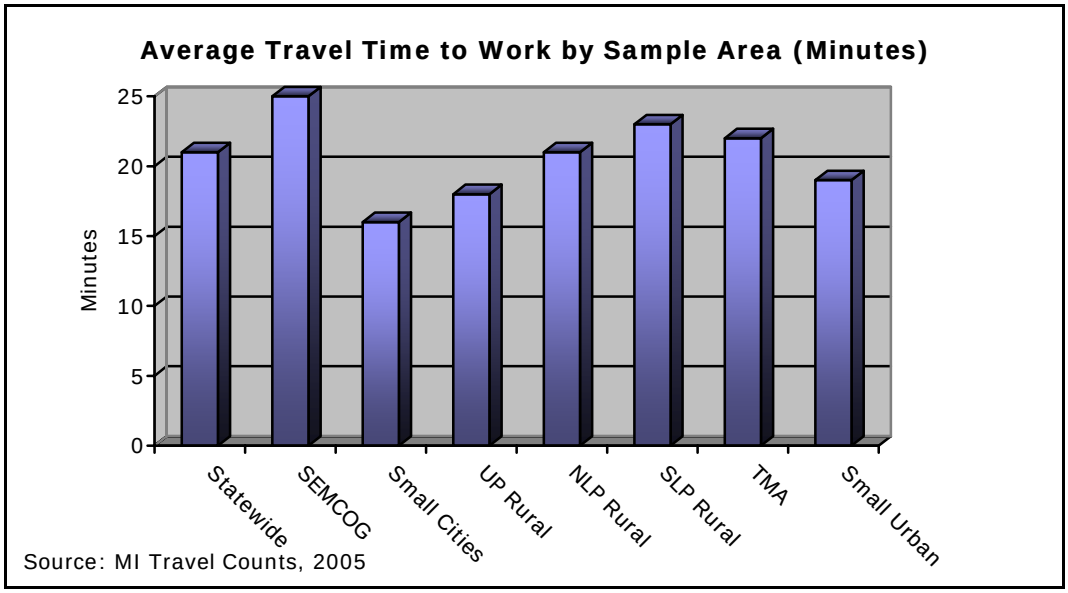
- *Figure 2:* (Unweighted) Average trips per person were highest in the Small Cities sample area (8.3), and lowest in the three rural areas (average 7.4).

Figure 3: Average Trips per Person by Age Group by Sample Area (48 Hour Travel Period)



- *Figure 3:* (Unweighted) Across all sample areas, average trips rates were highest for those age 35-54. Average trip rates were considerably lower for those 55 years or older living in the rural areas of the Northern Lower Peninsula and Upper Peninsula.

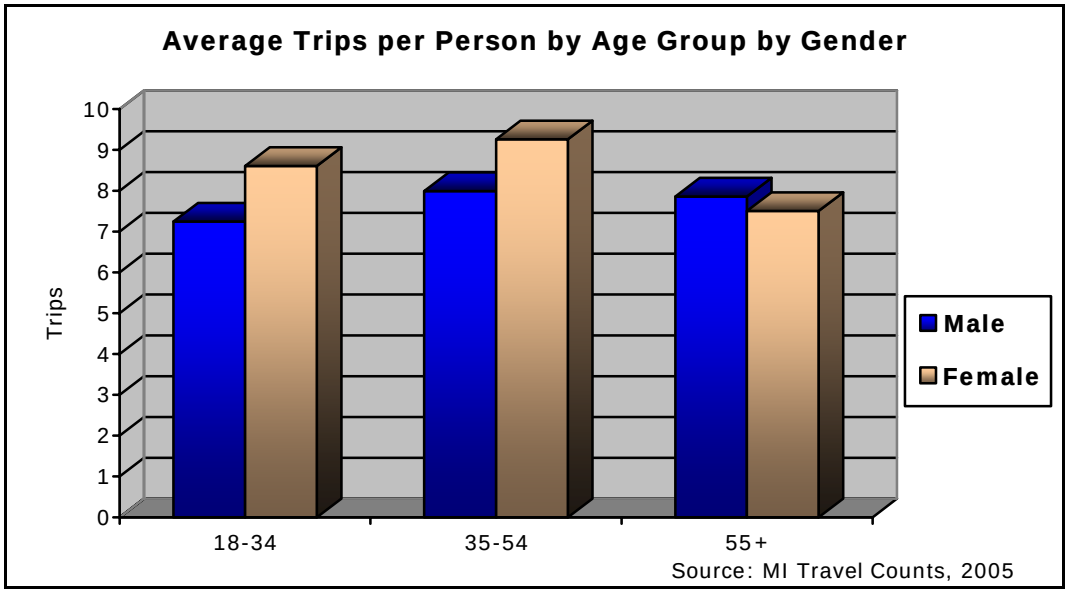
Figure 4: Average Travel Time to Work by Sample Area (Minutes)



- *Figure 4:* (Unweighted) The average travel time to work in the urban/suburban SEMCOG area was 25 minutes; average travel time to work was shortest in the Small Cities area (16 minutes). Average travel

time to work exceeded 20 minutes in the TMA and the rural areas of the Northern and Southern Lower Peninsula.

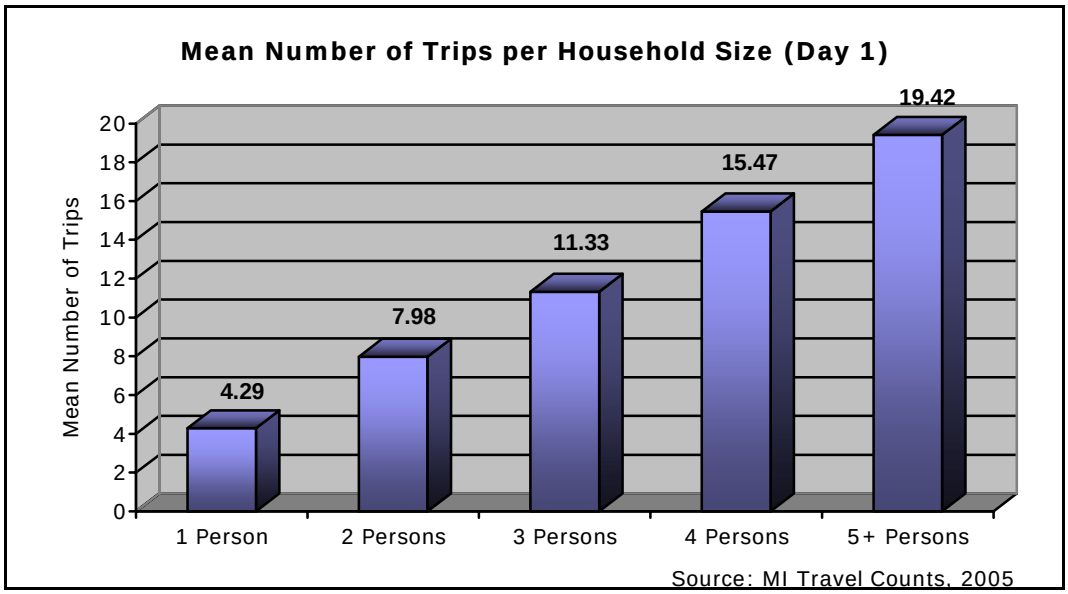
Figure 5: Average Trips per Person by Age Group by Gender (48 Hour Travel Period)



- *Figure 5:* (Unweighted) Females reported higher average trips than males for all age groups except 55 years and older where average trips for males were slightly higher than for females.

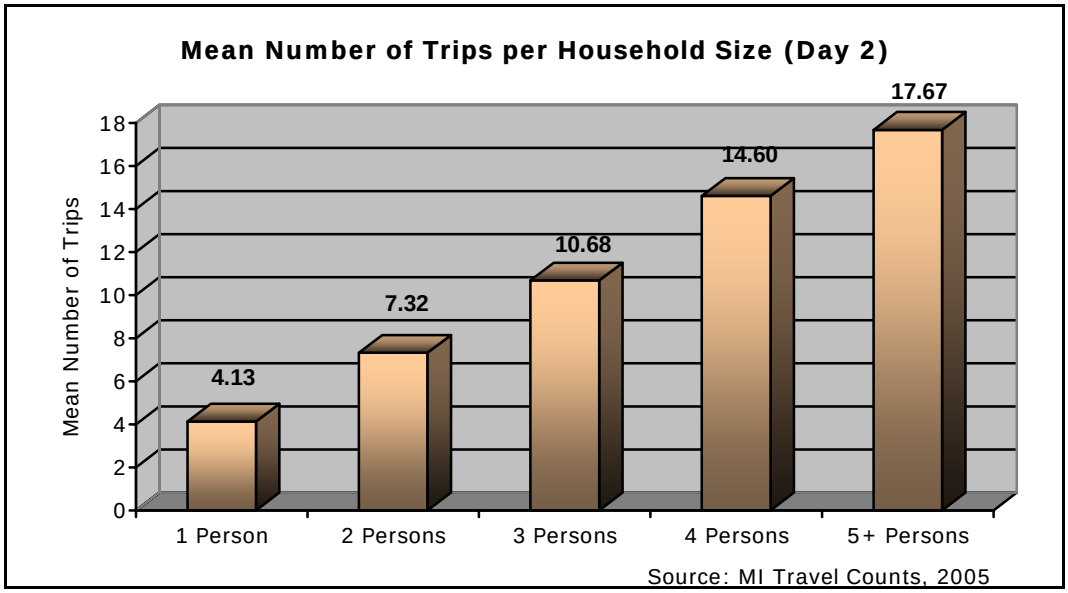
Figure 6 and Figure 7 below show the weighted (by household size) mean number of trips by household size for Day 1 and Day 2 travel respectively.

Figure 6: Mean Number of Trips per Household Size (Day 1)—Weighted



- *Figure 6:* (Weighted) On Travel Day 1, one person households averaged 4.29 trips while households with five or more persons averaged 19.42 trips per household. The mean weighted number of trips per household on Travel Day 1 was 9.99 trips.

Figure 7: Mean Number of Trips per Household Size (Day 2)—Weighted

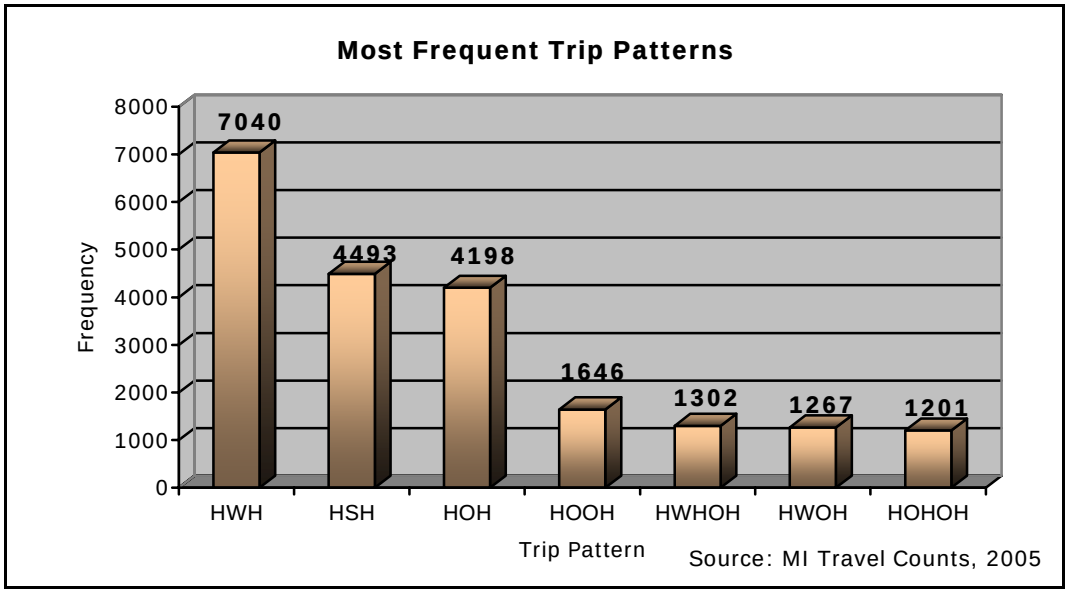


- *Figure 7:* (Weighted) On Travel Day 2, the mean number of trips per household was 9.42, a decline of 5.7% in reported trips from Travel Day 1. The decline in average number of reported trips from Day 1 to Day 2 was 3.7% for one person households and 9.0% for households with five or more persons.

Figure 8 below shows the most frequent type of travel day trip pattern where “H” is home, “W” is work, “S” is school, and “O” is some other destination. A pattern is defined as a closed chain of trips that start and end at a base location, typically home. For example, the most frequent pattern is from home to work and then back to home. The exception in frequency of patterns is the “HWHOH” which is a frequently occurring double pattern.

HWH = Home-Work-Home		*HSH = Home-School-Home*
HOH = Home-Other-Home		*HOOH = Home-Other-Other-Home*
HWHOH = Home-Work-Home-Other-Home		*HWOH = Home-Work-Other-Home*
HOHOH = Home-Other-Home-Other-Home		*HOOH = Home-Other-Other-Home*

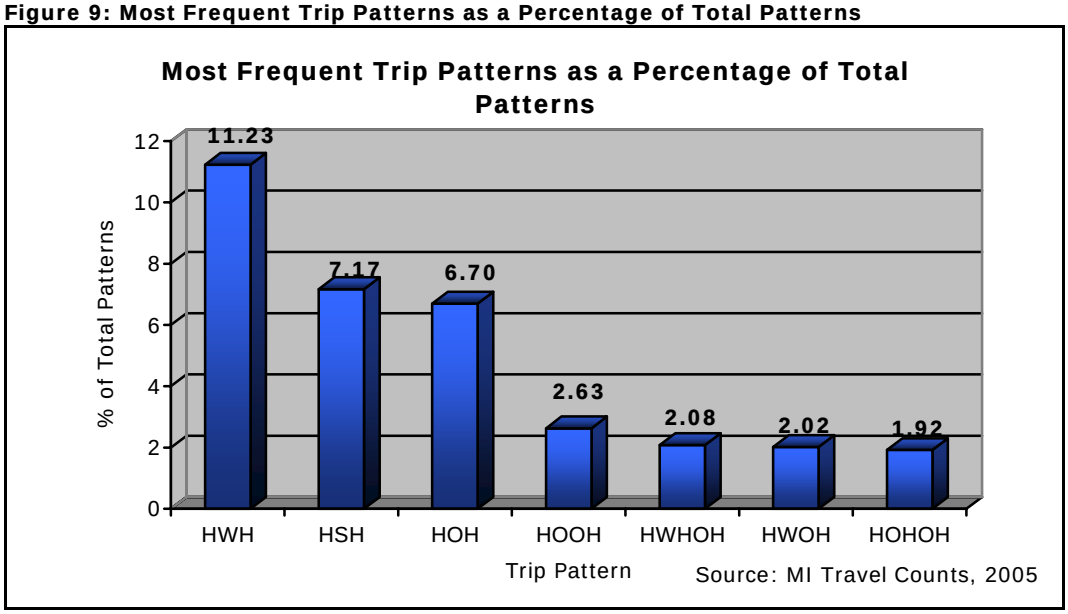
Figure 8: Most Frequent Trip Patterns



- *<u>Figures 8:</u>* (Weighted) Figure 8 shows the most frequent type of trip pattern (from one location to another and back).

There were 62,672 respondent travel days and 261,156 trips in the MI Travel Counts program from the 14,996 completed and accepted households. Figure 9 below shows the percent of each of these frequent trip patterns as a percent of total travel. The figure illustrates approximately 33.74% of all patterns, the other trip patterns were each less than 1.5% of the total patterns.

Figure 9: Most Frequent Trip Patterns as a Percentage of Total Patterns



- *Figures 9:* (Weighted) Figure 9 shows that the traditional types of trip patterns (home/work/home, home/school/home, and home/other location/home) account for only one-fourth of all patterns.

A more detailed description of the approach and analysis of the data are contained in the body and appendices of this report.