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DIRECT OBSERVATION OF SEAT BELT USE IN MICHIGAN: DECEMBER 1984

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16. Abstract

A direct observation survey was conducted in December, 1984, of 17,568 motor vehicle occupants at a carefully selected probability sample of 240 intersections throughout the State of Michigan. The sample was designed to adequately represent all regions of the state. Among drivers, 19.5% were using seat belts, among front seat passengers, 17.6% were restrained, and among all occupants, 19.8% were restrained. In Michigan, children under age four are required by law to be restrained when traveling in an automobile. Of the 538 children under four observed, 60.8% were restrained. Differential restraint use was examined by age, sex, seating position, time of day, day of week, type of roadway, weather conditions, vehicle type and size, and region of state. Use of occupant restraints was higher in December, 1984 than August, 1983, when an earlier survey was conducted.

As of July 1, 1985, all drivers and front seat passengers traveling in Michigan will be required by law to be restrained. Results of the current survey will function as a baseline from which the effects of the law will be measured. Additional survey waves are planned for 1985 and 1986.

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Chapter 1

INTRODUCTION

Motor vehicle crashes are a major public health problem in American society, and are the leading cause of death to people under the age of 40. In 1983 motor vehicle crashes killed 44,600 and injured an additional 1.7 million people. In Michigan alone the death toll was 1,331 in 1983. According to the National Safety Council, motor vehicle crashes cost Americans $43.3 billion in 1983, including medical expenses, insurance, and wage loss (National Safety Council, 1984). The costs in terms of human pain and suffering are incalculable. Currently existing occupant restraint systems have been proven to substantially reduce the risk of death and injuries due to motor vehicles. When properly used, adult restraint systems are 30 to 50% effective in preventing death and severe injuries. Estimated effectiveness of child restraint devices, when properly used, is even higher.

In the past 15 years numerous foreign countries have enacted laws mandating use of safety belts. These jurisdictions have typically experienced significant decreases in motor vehicle crash fatalities and injuries.[1] In the United States, New York, New Jersey, Illinois, and most recently, Michigan are the only states to have enacted mandatory seat belt legislation for adults. In February, 1985, the Michigan Legislature approved mandatory seat belt legislation for drivers and front seat passengers riding in vehicles manufactured after 1965. The Michigan law will become effective July 1, 1985. The New York law became effective December 1, 1984, but law enforcement officials did not begin issuing citations until January 1, 1985. The New Jersey law became effective March 1, 1985 and the Illinois law will take effect July 1, 1985.

Mandatory child passenger protection has been more readily accepted in the U.S. than adult seat belt laws, with all but one state having enacted legislation to protect children riding in cars. Michigan's child passenger protection law, which became effective in April, 1982, requires that children under the age of four be properly restrained by

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[1] Literature on effects of mandatory restraint laws has been reviewed in detail in previous reports (Wagenaar, 1984; Wagenaar and Webster, 1985).

an approved child restraint device. Children one to three years of age may be restrained by a conventional adult seat belt, provided they are riding in the rear seat. The effects of that law have been extensively examined (Wagenaar, 1984; Wagenaar and Webster, 1985). There is clear evidence that enactment of Michigan's child passenger legislation significantly increased the proportion of children under age four traveling restrained. Prior to passage of the law, the restraint use rate for crash-involved injured children age one to four averaged 12%. Immediately after the law went into effect, the use rate more than tripled, with the most recent data indicating a use rate of 51%. This increase in use was associated with a 25% reduction in the number of young children injured in traffic crashes (Wagenaar and Webster, 1985). A public information and education program implemented before the child restraint law took effect had much smaller effects on restraint use.

In addition to studies of crash-involved motor vehicle occupants, evaluation of efforts to increase restraint use should include examination of changes in restraint use among the general population of motorists on the road. The current study directly observed restraint use among a representative sample of Michigan motorists. Such information will serve as a baseline from which the effects of further efforts to increase seat belt use, including the new adult seat belt law, are measured.

Several observation studies of belt use have been conducted in Michigan, but most used inadequate samples of motorists at a limited number of sites. Both Opinion Research Corporation and Lincorp conducted surveys in August and November, 1977 to determine the effectiveness of a public awareness program. Opinion Research Corporation (1977) observed five sites in Traverse City and five in Marquette. They also observed six sites in Detroit in August and 14 sites in Detroit in November. Restraint use for drivers in the three cities averaged 14.7% in August and 14.5% in November. Lincorp (1978) observed 224 sites throughout southeastern Michigan (including Detroit). Restraint use for drivers was 12.4% in August and 16.8% in November. A more recent survey conducted by Opinion Research Corporation (1983) examined use in Midland and Portage, Michigan, before (November, 1981, to March, 1982) and after (April, 1982, to October, 1982) implementation of Michigan's child restraint law. Driver restraint use in Midland was 21.5% prior to the law and 22.1% after; in Portage the rates were 12.2% and 13.2%. Restraint use for passengers age 13 and over was 18% prior to the law in Midland and 26% after; in Portage the rates were 13% before and 15% after the law. An Insurance Institute for Highway Safety (1978) newsletter reported an April, 1978 survey of the Detroit area; 12% of observed drivers were belted. Thus, the limited evidence available indicates restraint use rates of 12 to 16% in Michigan during the

late 1970's and early 1980's.[2]

The most comprehensive survey of restraint use in Michigan to date was conducted by O'Day and Wolfe (1984) in August and September, 1983. The 1983 survey observed 13,812 vehicles at 217 sites throughout Michigan. Among drivers, 14.4% were restrained, and among passengers, 12.7% were restrained.

The current study fills important gaps in knowledge of restraint use patterns in Michigan. Research to date on the effects of Michigan's child restraint law and other efforts to increase restraint use has largely been based on analyses of crash-involved motorists. Those studies have provided important information on the effects of those efforts. However, periodic measurement of restraint use among a representative sample of motorists throughout Michigan will significantly improve our ability to monitor the effects of continuing efforts to increase the proportion of motor vehicle occupants protected by use of seat belts.

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[2] Excluding the unusually high rates in Midland that apparently resulted from special programs in that community.

Chapter 2

METHODS

When comparing the results of this study with those of other studies, it is important to consider whether any observed differences might be accounted for by the specific methods used. Many studies of restraint use are based on limited samples and have not used modern survey and data processing techniques. Explicit design of a representative sample, collection of data by trained observers, and careful checking and processing of the resulting data are prerequisites for obtaining an accurate estimate of restraint use among the general motoring population of the entire state.

2.1 Sample Design

The goal of the sample design was selection of observation sites that would accurately represent all motorists traveling on Michigan roads. Design of the best sample involved minimizing the total survey error, including sampling error and measurement error, while providing sites where observations could be made efficiently and economically. To observe **all** modes of restraint use of **all** occupants of motor vehicles (not just shoulder belt use among drivers and right front passengers), vehicles had to be stopped for at least several seconds. Therefore, observation sites were generally limited to intersections with three-color cycling traffic signals. Flashing red lights and stop signs generally do not require stop times long enough for accurate observation of restraint use for all occupants. Alternatives such as stopping motorists traveling on randomly selected road segments (presumably with police assistance), or observing motorists at non-roadway locations (e.g., parking lots) were either too cumbersome and expensive or insufficiently representative of the traveling population. Another advantage of using signalized intersections was that they generally provide sufficient traffic to keep observers busy without long wait periods between vehicles.

To provide adequate coverage of the entire state, 240 intersections were selected, using a multi-stage stratified probability sampling procedure. The first step in selecting

intersections was identification of all counties in Michigan with at least three signalized intersections. Calls to road commissions and sheriff's departments in all rural counties revealed 20 counties (out of a total of 83 Michigan counties) that did not meet this minimum criterion. These counties were grouped with those of adjacent counties to form 63 counties and county groups.

The 63 jurisdictions were then divided into seven regions: upper peninsula, and northern, western, central, south central, eastern, and southeastern lower peninsula. The upper peninsula and northern lower peninsula regions were overrepresented in the sample in relation to their populations in order to provide sufficient cases for analysis by region. Even though the upper peninsula contains 3.46% and the northern lower peninsula contains 5.37% of the state's population, each region was allocated 20 sites (8.33% of the total 240 sites).[3] Similarly, the densely populated southeastern region of the state was underrepresented. Although containing 57.8% of the state's population, the southeastern region was allocated 50% of all sites (120 of 240).

The remaining four regions were each allocated 20 sites in the sample. Percent of the state's population in each region is: 8.23% in western, 8.46% in central, 8.35% in south central, and 8.23% in eastern. Because the northern regions were overrepresented and the southeastern region was underrepresented in the sample, all results presented are based on data reweighted according to the sampling fraction used in each region; weighting was required to provide accurate estimates of restraint use for the entire population of the state.

The 63 counties and county-groups in the seven regions were candidate primary sampling units (PSUs). Five PSU selections were made in each region except the southeastern region, where 30 PSU selections were made. Four observation sites were chosen for each of the 60 PSUs, for a total of 240 sites in the sample. PSUs were selected such that the largest candidate counties (or county-groups) had the highest probability of inclusion in the sample. The total population of a region was divided by five (except the southeastern, where 30 was the divisor), producing a quotient used as the systematic sampling fraction. Five PSU selections were made systematically, using a random start from the ordered cumulative population distribution for each region (except the southeastern, where 30 PSUs were selected). In some cases additional PSU selections were in the same county as the first PSU selection because of the large population in the county.[4] Thus, a total of 60 PSU selections were made, resulting in 32 counties

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[3] All population figures are based on the 1980 census.

[4] The following counties were selected more than once, with the number of selections shown in parentheses: Berrien (2), Genesee (3), Ingham (2), Kalamazoo (2), Kent (3), Macomb (3), Marquette (2), Oakland (6), Saginaw (2), and Wayne (13).

and county-groups being included in the sample.

For the 32 counties and county-groups, a complete list of signalized intersections was constructed, using information provided by the Michigan Department of Transportation, county road commissions, and city transportation departments.[5] Because seven large counties had so many signalized intersections, they were divided into sub-areas consisting of individual cities, groups of cities, and the remaining non-incorporated area of the county. One sub-area was selected for each PSU-selection allocated to that county, using the same probability-proportionate-to-size procedure used for selection of counties within regions. From these seven large counties, 19 sub-county areas were selected into the sample. Therefore, the final sample included 44 areas: three consisting of two counties each, 22 consisting of a single county, and 19 consisting of sub-county districts.

The final step in the sample design was the selection of intersections for observation within each of the 44 sampling areas. Four intersections were randomly selected for each PSU selection allocated to that area. Because an estimated 23% of all traffic in Michigan occurs on freeways (Federal Highway Administration, 1982), one freeway exit and three non-freeway intersections were selected for each PSU allocated to a community. Separate lists of freeway exit and regular signalized intersections were used to systematically select (with random start) the intersections required. In the City of Detroit 21 small areas of the city were first randomly selected from a grid map. Lists of all intersections within the selected areas were then constructed, and specific intersections were selected systematically (with random start). In each sampling area, two alternative sites were also systematically selected for each chosen intersection where possible.

In some areas in the sample, no signalized freeway intersections existed. For Berrien County (excluding Niles); Berrien County, City of Niles; and Van Buren County; stop-sign freeway exits onto roads with fairly heavy traffic flow were used instead. For five other areas in the sample (Barry, Lenawee, Monroe, Montcalm, and Saginaw) freeway exits were selected in adjacent counties. For nine areas no nearby signalized freeway exits existed, so they were replaced with additional regular intersections. The final sample of 240 sites included 190 regular intersections and 50 freeway exits. Freeway exits therefore constituted 20.8% of the sites, representing the estimated 23% of all vehicle miles traveled on freeways in Michigan.

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[5]The state inventory of Electrical Traffic Control Devices was supplemented by lists and maps from local traffic authorities to form complete lists of signalized intersections in each sampling area.

After the sample of 240 sites was selected, further sampling considerations determined the schedule for observing a particular site. The goal was to represent motor vehicle occupants at all times on Michigan roads. Observations were limited to daylight hours for accurate observation of restraint use. Because field observations were conducted in the last week of November and the first two weeks of December, when daylight hours are short, no observations were made during the evening or at night. Observations were well distributed across the hours of adequate daylight, however, as Table 2.1 shows. Observations were also carefully distributed across the days of the week, with slightly more observations purposely conducted on Saturdays and Sundays than each of the weekdays (Table 2.1). Based on previous studies, the major differences across day of week were expected between weekend days and the rest of the week. Therefore, observations were distributed in such a way to ensure adequate representation of weekend days.

Table 2.1 also indicates that virtually all observation sites were the primary assigned site; in 2.1% of the cases the primary site was not appropriate (construction or signal on flashing mode), and the alternate site was observed. The distribution of observations across weather conditions was as expected for this season of the year. Most of the sites were observed during cloudy weather, and 22.6% of the sites were observed while it was raining or snowing.

2.2 Data Collection

2.2.1 Design of Data Collection Forms

The project used three forms: (1) vehicle form, (2) site form, and (3) daily travel record. One vehicle form was used for each vehicle observed (See Appendix A). Recorded information included: vehicle size, restraint use, estimated age, and sex of occupants of the six primary seating positions. A comment section was used to record information on other passengers present in the vehicle (including children in laps), car model, and any other unusual characteristics of the vehicle or its occupants. Three vehicle forms were printed on a single 8-1/2 x 14 sheet in an effort to reduce the amount of page turning needed during an observation period. Each of the primary seating positions was listed left to right across the form: driver, front center, front right, rear left, rear center, and rear right. Under each seating position the items to be recorded were listed: restraint use, sex, and approximate age. Boxes were placed at the left of each item to be marked with a horizontal line. The vehicle size/type item was located at the bottom of the form. To the right of vehicle size/type was a vehicle identifier code and a section

TABLE 2.1
Descriptive Statistics for the 240 Observation Sites

Day of Week		Start Time		Site Choice		Weather		Observer	
Monday	12.5%	8–10 AM	27.1%	Primary	97.9%	Sunny	21.8%	(A)	26.7%
Tuesday	14.2%	10–12 AM	23.3%	Alternate	2.1%	Cloudy	55.6%	(B)	29.2%
Wednesday	13.8%	12–2 PM	20.3%			Rain	12.6%	(C)	29.6%
Thursday	12.9%	2–4 PM	23.8%			Snow	10.0%	(D)	14.6%
Friday	13.8%	4–6 PM	5.5%						
Saturday	16.7%								
Sunday	16.3%								
TOTALS	100.0%		100.0%		100.0%		100.0%		100.0%

for comments. The form was precoded for accurate keypunching by including code values to the left of each category and column numbers at the bottom of each item. The layout of the vehicle form was designed to be clear to both the observer recording data in the field and to keypunchers and others reviewing the data forms after the field work was completed.

Vehicle forms were assembled into packets of 51, one form for every vehicle to be observed. A single packet was used to record data at a single site. Each packet was attached to a site form which described the location (see Appendix B). The site form provided environmental information such as site number, street names, site type (intersection or freeway exit), site choice (primary or alternate site), date, time of day, day of week, weather, and a comments section. A diagram was also provided for observers to sketch the intersection and indicate observation points and traffic flow. Observers were encouraged to write comments about each site (e.g., why the specific observation position was chosen, traffic flow, and any other unusual characteristics of the site). As with the vehicle form, the site forms were precoded for keypunching purposes.

The third form, daily travel record, was used by observers to record their actual observation schedule (see Appendix C). One travel record was used for each day requiring each observer to record the date, starting location, starting time, each destination visited, and the departure and arrival time for each destination. This allowed determination of the exact hours worked by the observer as well as the travel time needed between sites. This information is useful for refining observation schedules for future survey waves. The daily record also functioned as an expense form, providing space for the observer to record all expenses incurred.

2.2.2 Observer Training

The seat belt observers met at The University of Michigan Transportation Research Institute (UMTRI) with other project staff for three days of intensive training. The history of the project, the sampling design, data collection procedures, and the study's goals and objectives were reviewed. Previous studies of restraint use conducted by UMTRI were summarized.

Each observer was provided with written instructions that were carefully reviewed and discussed. The instructions included a brief summary of the project, general information on each site assigned, time schedules, and procedures for recording data (see Appendix D). Each observer was given a detailed time schedule which listed the site

number, street names, and the specific time during which observation was to take place at each location (see Appendix F). Sample data collection forms were distributed and the coding of each category of each variable was discussed.

After the data collection procedures were discussed, additional time was spent reviewing the coding of the core restraint use item. Kathleen Weber of the Biomechanics Department at UMTRI introduced various types and models of child restraint devices. Sample seats for each major category of child restraint device (infant, toddler, booster) were available for examination. Proper and improper use of each type of seat was discussed. Since it was difficult to observe whether a child restraint device (CRD) was properly installed in the vehicle in the brief observation time available, misuse was determined by how the child was secured in the seat rather than how the seat was secured to the vehicle (unless obviously secured improperly, for example, an infant seat facing forward). Booster seats with shields were considered a CRD, while booster seats without shields were not considered a CRD. A child in a booster without a shield was coded as "belted" or "unrestrained," depending on whether the child was belted. Results of this survey, therefore, clearly provide a **minimum** estimate for the proportion of CRDs that are used incorrectly. Results are best considered an estimate of "obvious incorrect" use only. Misuse of child restraints is a significant problem, and the routing of the seat belt through the CRD is a major source of incorrect use not measured by this study. Further surveys are planned to specifically measure the extent of incorrect CRD use in Michigan.

During the second day of training the observers were taken to pre-selected practice sites, including regular signalized intersections and a freeway exit ramp. Although all observers monitored the same site, data were recorded individually. After each site the team met with the project director to discuss each person's observations and to determine any difficulties in coding categories of such items as restraint use, age, vehicle size, and sex.

After practice at several sites, followed by group discussion, the observation procedures were well understood by the observers. The observers then worked in teams of two observing the same vehicles, but completing their own sets of data forms. The project director compared the two sets of data forms. Any discrepancies were noted and discussed with the two observers. Further combinations of practice site observations with immediate review by the project director significantly improved inter-observer reliability.

During the third day observers again worked in teams of two, with composition of the teams rotated so that each observer was paired with every other observer. Practice observations continued at a variety of sites until inter-observer differences in coding

were minimal. The additional practice sites were selected to represent the range of situations the observers would encounter in the field (e.g., rush hour versus non-rush hour, sites with a significant number of children versus sites with few children).

At the end of the third day of training, observers were given maps for all counties in which they had been assigned sites and all necessary supplies were distributed. The observers were cautioned about the importance of conducting the observations carefully, and of observing the **exact** site assigned at the **exact** time scheduled. The observers were told the project director or field supervisor would make unannounced visits to observers at the specific sites assigned.

2.2.3 Observer Supervision and Monitoring

Each observer was spot checked at least twice during the three-week observation period by the project director or field supervisor. Observers also telephoned the UMTRI office at least twice a week to report their progress and discuss any difficulties they may have encountered. The biweekly calls and spot checks in the field kept the observers in close contact with supervisors. Field observers were given both the office and home phone numbers of supervisors and were told to call whenever a question or problem arose. Based on the unannounced visits to each field observer and review of site forms, observers were found to deviate a maximum of 10 minutes from the specific site schedules assigned.

As observers turned in the data recording sheets, they were reviewed immediately by the project director and field supervisor and re-coded when necessary (for example, coding vehicle size when observers had recorded make/model but indicated that they were unsure of vehicle size code). During this review process, data on occupants not in the six primary seating positions (e.g., passengers riding on other passengers' laps, in cargo areas, or in third or fourth seats) were coded from the comments section onto separate coding sheets. State-owned vehicles were also coded separately for a sub-study completed for the Michigan Office of Highway Safety Planning.

Each site form was reviewed with the observer during debriefing sessions. During this session the observer's comments on specific sites were recorded for use in the data collection process of future survey waves.

2.3 Data Processing

All site description forms and vehicle observation forms were both keypunched and verified to ensure data accuracy.[6] All raw data files were then carefully examined for errors by checking for invalid codes (e.g., sex=3) or inconsistent codes (e.g., driver age=1). A small number of errors was found and corrected after consulting the original data collection forms.

The site-level and vehicle-level data files were merged so that all site-level information was attached to the records for all vehicles observed at that particular site. The vehicle-level data file was then used to construct an occupant file which had one case for each occupant observed. As a result, all site- and vehicle-level items were attached to each occupant record. Finally, all occupants observed outside the six primary seating positions were added to the occupant file, providing a single comprehensive data file on **all** occupants observed.

The OSIRIS system of data analysis software was used to generate study results, because it allows differential weighting of sample observations. Observations were weighted by region of the state to take into account the overrepresentation of the northern rural regions and underrepresentation of the urban southeastern region of the state in the sample design. Secondly, observed vehicles at the few sites where fewer than 51 vehicles were observed were weighted to represent the full complement of 51 vehicles called for in the sample design. Unless noted otherwise, all estimates of restraint use in this report are based on analyses after weighting. The weighted analyses provide the most accurate estimate of restraint use patterns for the state as a whole.

2.4 Description of Actual Sample Observed

Sample distributions for the major variables measured are shown in Table 2.2. Detailed results are described in Chapter 3. Table 2.2 shows the actual number of occupants observed within each major subcategory. Estimates based on a small number of cases, such as those for occupants in extra seats or cargo areas, need to be interpreted with care.

In addition to showing the actual number of cases by subcategory, Table 2.2 indicates the extent of missing data for each variable. Note that the key restraint use item was missing for only 1.8% of all occupants observed. These are cases in which the observer could not accurately identify whether the occupant was restrained. Belt use

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[6]Verification refers to keypunching all data twice and comparing the two resulting data sets to locate and correct keypunch operator errors.

TABLE 2.2
Sample Distributions for Major Variables by Seating Position, Unweighted Ns and Percent Missing Data

	Seating Position									
	Driver	Front Center	Front Right	Rear Left	Rear Center	Rear Right	Extra Seats	Cargo Area	Held in Lap	All
Restraint Use										
None	9,531	168	3,163	247	233	361	10	30	81	13,824
Belted	2,312	22	623	85	41	92	11	0	0	3,186
CRD Correct	–	14	37	46	37	50	0	0	0	184
CRD Wrong	–	9	10	7	7	16	0	0	0	49
Missing	63	33	47	47	31	92	12	0	0	325
% Missing	0.5	13.4	1.2	10.9	8.9	15.1	36.4	0.0	0.0	1.8
Sex										
Male	7,256	94	1,260	206	164	232	8	13	25	9,258
Female	4,634	129	2,583	201	157	343	2	8	21	8,078
Missing	16	23	37	25	28	36	23	9	35	232
% Missing	0.1	9.3	1.0	5.8	8.0	5.9	69.7	30.0	43.2	1.3
Age										
0–3	–	70	108	95	94	103	2	7	59	538
4–15	2	78	478	209	199	259	21	22	16	1,284
16–29	4,366	64	1,205	52	33	114	0	0	1	5,835
30–59	6,408	25	1,528	50	11	72	4	1	1	8,100
60+	1,086	4	542	24	6	61	0	0	0	1,723
Missing	44	5	19	2	6	2	6	0	4	88
% Missing	0.4	2.0	0.5	0.5	1.7	0.3	18.2	0.0	4.9	0.5
Vehicle Type										
Small Car	2,752	9	857	97	65	143	0	2	17	3,942
Midsize Car	3,102	39	983	130	100	178	2	4	16	4,554
Large Car	3,938	88	1,392	165	142	240	3	14	22	6,004
Pickup	1,225	88	349	1	1	1	0	0	14	1,679
Van	511	5	162	20	20	21	28	2	4	773
Other	351	12	117	10	12	16	0	8	7	533
Missing	27	5	20	9	9	12	0	0	1	83
% Missing	0.2	2.0	0.5	2.1	22.6	2.0	0.0	0.0	1.2	0.5
Site Type										
Intersection	9,674	194	3,091	330	267	479	23	26	68	14,152
Freeway Exit	2,232	52	789	102	82	132	10	4	13	3,416
Missing	0	0	0	0	0	0	0	0	0	0
Day of Week										
Monday	1,502	32	393	33	22	50	2	4	8	2,046
Tuesday	1,720	25	469	42	37	67	2	4	6	2,372
Wednesday	1,641	21	469	41	30	66	8	1	11	2,288
Thursday	1,575	27	396	42	23	63	1	3	6	2,136
Friday	1,644	32	445	44	37	48	1	0	14	2,265
Saturday	1,968	53	808	101	89	135	6	11	18	3,189
Sunday	1,856	56	900	129	111	182	13	7	18	3,272
Missing	0	0	0	0	0	0	0	0	0	0

TABLE 2.2 Continued

	Seating Position									
	Driver	Front Center	Front Right	Rear Left	Rear Center	Rear Right	Extra Seats	Cargo Area	Held in Lap	All
Time of Day										
8-9 AM	1,109	14	266	33	28	44	3	1	4	1,502
9-10 AM	1,017	26	275	42	33	46	10	7	3	1,459
10-11 AM	1,507	28	430	45	44	60	3	7	10	2,134
11-12 AM	2,192	49	741	91	61	124	3	6	25	3,292
12-1 PM	1,245	18	490	50	40	80	4	4	11	1,942
1-2 PM	1,535	30	527	45	42	71	2	0	10	2,262
2-3 PM	1,623	32	566	63	58	99	5	0	9	2,455
3-4 PM	846	21	290	36	24	52	1	3	7	1,280
4-5 PM	818	28	292	26	19	35	2	2	2	1,224
5-6 PM	14	0	3	1	0	0	0	0	0	18
Missing	0	0	0	0	0	0	0	0	0	0
Weather										
Sunny	2,561	69	1,001	127	106	182	5	10	22	4,083
Cloudy	6,597	135	2,134	230	184	313	26	14	42	9,675
Rain	1,495	21	371	31	34	50	2	1	8	2,013
Snow	1,202	20	356	42	25	62	0	5	9	1,721
Missing	51	1	18	2	0	4	0	0	0	76
% Missing	0.4	0.4	0.5	0.5	0.0	0.7	0.0	0.0	0.0	0.4
MDOT Region										
Western U.P.	603	14	179	19	17	22	1	0	1	856
Eastern U.P.	388	16	139	17	10	18	0	0	4	592
Northwest	612	11	225	21	17	30	0	4	9	929
Northeast	401	5	151	8	10	17	2	0	4	598
West Central	1,386	44	410	50	38	75	3	13	15	2,034
East Central	1390	33	462	43	32	64	2	1	3	2,030
Southwest	1,311	37	430	40	41	59	0	4	12	1,934
Southeast	1,200	24	343	34	34	37	1	1	11	1,685
Metro Detroit	4,615	62	1,541	200	150	289	24	7	22	6,910
Missing	0	0	0	0	0	0	0	0	0	0
TOTAL N	11,906	246	3,880	432	349	611	33	30	81	17,568

was not recorded for only 0.5% of the 11,906 drivers observed, and 1.2% of the 3,880 front right occupants observed. The highest level of missing data on restraint use was for occupants in third and fourth seats of station wagons and vans (36.4%). This was largely due to darkly tinted windows obscuring the view of occupants in third and fourth seats of vans. Front center and rear seat positions had moderate levels of missing data on restraint use.

Missing data rates for all other variables were less than 1%, with the exception of sex of occupant, which was not determined for 1.3% of occupants observed. Many of the occupants for which sex was not determined were young children in front center and rear seat positions. However, the sex of 16 drivers also could not be determined by the observer; in some cases observation of sex of occupant was complicated by heavy clothing typically worn in Michigan in December. Overall, the missing data rates were extremely low, particularly so when considering the winter weather conditions during the observation period.

The average number of occupants per vehicle is shown in Table 2.3. The most noteworthy difference is between weekdays and weekends. The average number of occupants per vehicle changes little from Monday to Friday, but is considerably higher on Saturday and Sunday. The average number of occupants in pickup trucks is slightly lower than other types of vehicles. The number of occupants per vehicle is slightly lower early in the morning and late in the afternoon than mid-day. This table illustrates the utility of data obtained in this survey for information on exposure to risk of crash injury. In contrast to other direct observation surveys of seat belt use, the current survey collected information on **all** occupants of each vehicle. Availability of such comprehensive data for the general population of motorists on the road will assist in improved understanding of changes in crash involvement and injury patterns, and will help in evaluating the effects of Michigan's mandatory adult seat belt law. For example, Wagenaar and Webster (1985) found indications that Michigan's child restraint law may have had a side effect of moving some young children from traveling in the front seat to rear seat positions. Since Michigan's adult seat belt law applies to front-seat occupants only, one effect of that law **may** be to increase the proportion of automobile passengers traveling in the rear seat. Repeated waves of the present survey both before and after the law is implemented will allow measuring whether such an effect occurred.

TABLE 2.3
Mean Number of Occupants for Major Variables by Day of Week (weighted)

	Unwtd.N	Mon.	Tues.	Wed.	Thur.	Fri.	Sat.	Sun.	Total
Sex of Driver									
Male	7,256	1.31	1.35	1.38	1.33	1.33	1.62	1.77	1.48
Female	4,634	1.42	1.39	1.40	1.39	1.40	1.58	1.73	1.48
Age of Driver									
16-29	4,366	1.35	1.40	1.41	1.31	1.37	1.62	1.57	1.44
30-59	6,408	1.36	1.32	1.36	1.35	1.34	1.63	1.90	1.49
60+	1,086	1.37	1.51	1.47	1.55	1.43	1.46	1.68	1.50
Vehicle Type									
Small Car	2,752	1.34	1.33	1.32	1.30	1.33	1.61	1.66	1.44
Midsize Car	3,102	1.34	1.39	1.36	1.33	1.35	1.58	1.80	1.48
Large Car	3,938	1.40	1.40	1.48	1.43	1.40	1.64	1.79	1.53
Pickup	1,225	1.28	1.29	1.27	1.23	1.35	1.50	1.60	1.37
Van	511	1.32	1.35	1.39	1.33	1.28	1.54	1.91	1.47
Other	351	1.39	1.31	1.44	1.42	1.29	1.80	1.95	1.50
Site Type									
Intersection	9,674	1.37	1.38	1.40	1.36	1.36	1.61	1.69	1.46
Freeway Exit	2,232	1.32	1.32	1.31	1.33	1.33	1.59	1.88	1.53
MDOT Region									
Western U.P.	603	–	1.42	1.42	1.41	–	–	–	1.42
Eastern U.P.	388	1.42	–	–	–	1.68	–	–	1.55
Northwest	612	1.33	–	–	1.40	–	–	1.82	1.52
Northeast	401	–	1.48	1.50	–	–	–	–	1.49
West Central	1,386	1.36	1.39	1.33	–	1.46	1.88	–	1.47
East Central	1,390	1.36	1.27	1.26	1.37	–	1.70	1.78	1.46
Southwest	1,311	–	–	1.39	1.32	1.40	1.71	1.76	1.49
Southeast	1,200	1.57	1.37	1.46	1.31	1.30	1.55	–	1.40
Metro Detroit	4,615	1.28	1.37	1.40	1.36	1.32	1.53	1.75	1.50
Time of Day									
8-9 AM	1,109	1.19	1.35	1.24	1.35	1.27	1.47	1.48	1.36
9-10 AM	1,017	1.33	1.30	1.28	1.24	1.35	1.41	1.90	1.45
10-11 AM	1,507	1.24	1.31	1.26	1.32	1.29	1.64	1.72	1.42
11-12 AM	2,192	1.29	1.45	1.39	1.40	1.42	1.70	1.70	1.50
12-1 PM	1,245	1.52	1.41	1.43	1.41	1.36	1.70	1.80	1.54
1-2 PM	1,535	1.34	1.29	1.35	1.38	1.40	1.66	1.83	1.49
2-3 PM	1,623	1.48	1.37	1.45	1.33	1.35	1.60	1.76	1.51
3-4 PM	846	1.47	1.54	1.44	1.24	1.46	1.66	1.69	1.52
4-5 PM	818	1.47	1.67	1.45	1.32	1.30	1.61	2.05	1.51
5-6 PM	14	1.29	–	–	–	–	–	–	1.29
TOTAL	11,906	1.36	1.37	1.39	1.35	1.36	1.61	1.76	1.48
Unweighted N	11,906	1,502	1,720	1,641	1,575	1,644	1,968	1,856	11,906

Chapter 3

RESULTS

Among drivers in Michigan during December, 1984, 19.5% were using seat belts. Among front seat passengers, 17.6% were restrained, and among all motor vehicle occupants, 19.8% were restrained. These results indicate an increase in restraint use from the 12% to 16% range typically found in the limited surveys conducted in the late 1970s and early 1980s.

3.1 Restraint Use by Demographic and Other Factors

Results of the current survey indicated clear differences in restraint use depending on seating position, age, sex, vehicle type, freeway versus surface street traffic, weather conditions, region of state, city or community of observation, time of day, and day of week. In terms of seating position, occupants seated in third or fourth seats of station wagons and vans had the highest rate of restraint use, 54.1% (Table 3.1 and Figure 3.1). This estimate should be interpreted cautiously, however, because it is based on only 33 occupants observed in such seats, and restraint use could not be determined for 12 of these occupants (see Table 2.2). Rates were also quite high for rear seat positions: rear left 35.8%, rear right 30.6%, and rear center 25.4%. High use rates in rear seats are the result of high restraint use among children age 0-3 who are required by law to be restrained. Occupants age 16 and over in rear seat positions had considerably lower rates of belt use than children in rear seating positions.

Motor vehicle occupants under age four had by far the highest rate of restraint use, 60.8% (Figure 3.2). Beginning in April, 1982, children under age four were required by law to be restrained when traveling in an automobile or light truck. Wagenaar and Webster (1985) found that restraint use among children injured in traffic crashes increased from 12% before to 51% after the law took effect. Results of the current direct observation survey of noncrash-involved occupants corroborate the high rates of restraint use found in the crash data. The effect of the law was also seen when

TABLE 3.1
Restraint Use by Age and Seating Position[1]

Age Group	Seating Position									
	Driver	Front Center	Front Right	Rear Left	Rear Center	Rear Right	Extra Seats	Cargo Area	Held in Lap	All[2]
Age 0-3										
% Belted	–	13.6	33.4	28.5	14.2	20.6	46.9	0.0	0.0	20.2
% Correct CRD	–	18.2	31.1	44.3	38.5	48.7	0.0	0.0	0.0	32.4
% Incorrect CRD	–	12.9	8.9	6.7	5.0	13.9	0.0	0.0	0.0	8.2
% Restrained[3]	–	44.7	73.4	79.5	57.7	83.1	46.9	0.0	0.0	60.8
Unweighted N	–	70	108	95	94	103	2	7	59	538
Age 4-15										
% Restrained	100.0	13.5	25.0	31.0	15.6	25.5	63.5	0.0	0.0	23.9
Unweighted N	2	78	478	209	199	259	21	22	16	1,284
Age 16-29										
% Restrained	20.8	4.2	12.2	6.6	2.3	8.8	–	–	0.0	18.5
Unweighted N	4,366	64	1,205	52	33	114	0	0	1	5,835
Age 30-59										
% Restrained	19.1	0.0	16.3	10.2	0.0	9.3	0.0	0.0	0.0	18.4
Unweighted N	6,408	25	1,528	50	11	72	4	1	1	8,100
Age 60+										
% Restrained	15.6	30.8	13.9	0.0	0.0	8.1	–	–	–	14.6
Unweighted N	1,086	4	542	24	6	61	0	0	0	1,723
All Ages										
% Restrained	19.5	20.2	17.4	35.8	25.4	30.6	54.1	0.0	0.0	19.8
Unweighted N	11,906	246	3,880	432	349	611	33	30	81	17,568

[1]All percents are based on analyses weighted according to the sample design to accurately represent the entire state. Unweighted Ns indicate the actual number of occupants observed in a given group.
[2]Restraint use for all positions includes cargo areas and passengers held in laps.
[3]Percent restrained includes correct and incorrect CRD use.

Figure 3.1

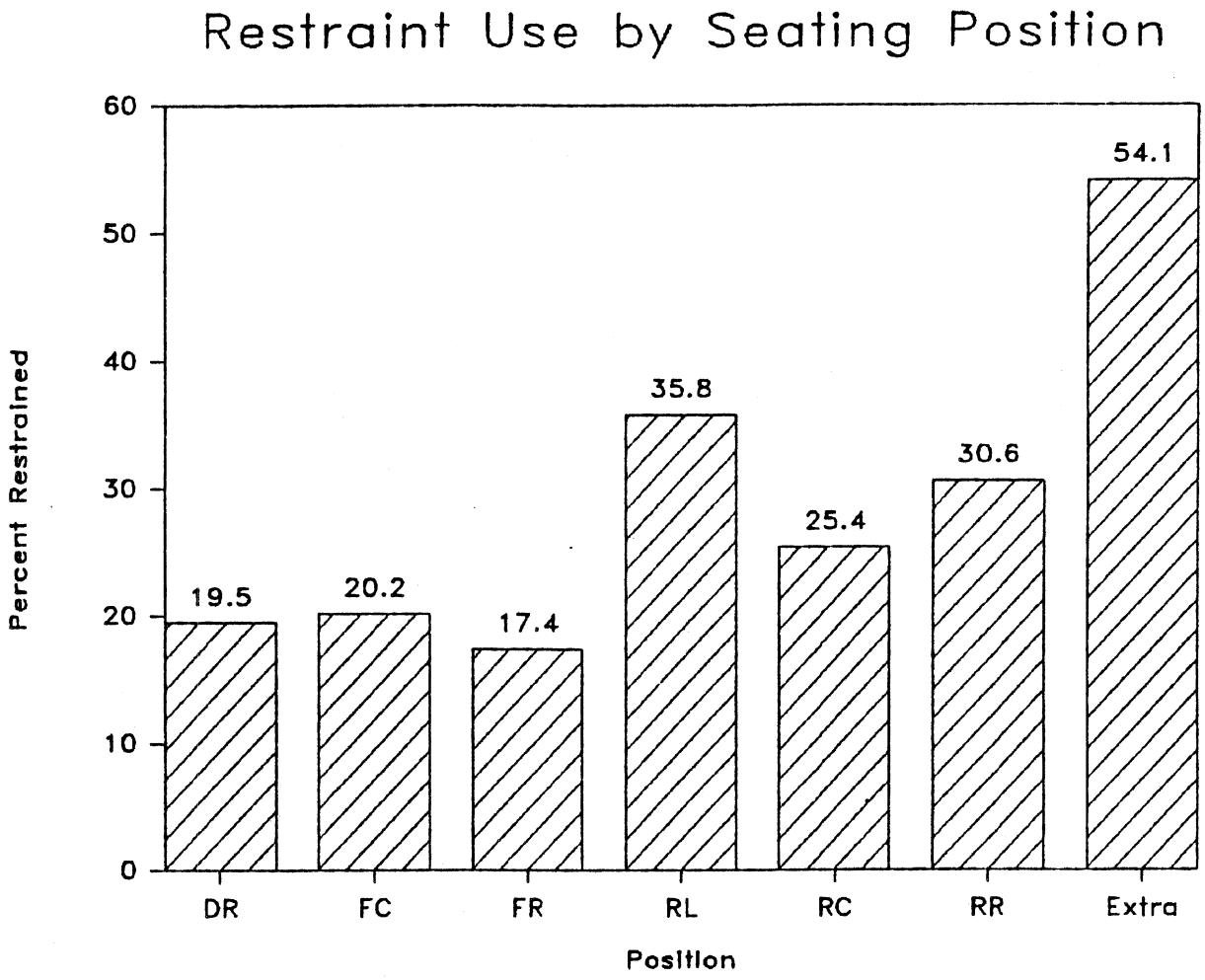
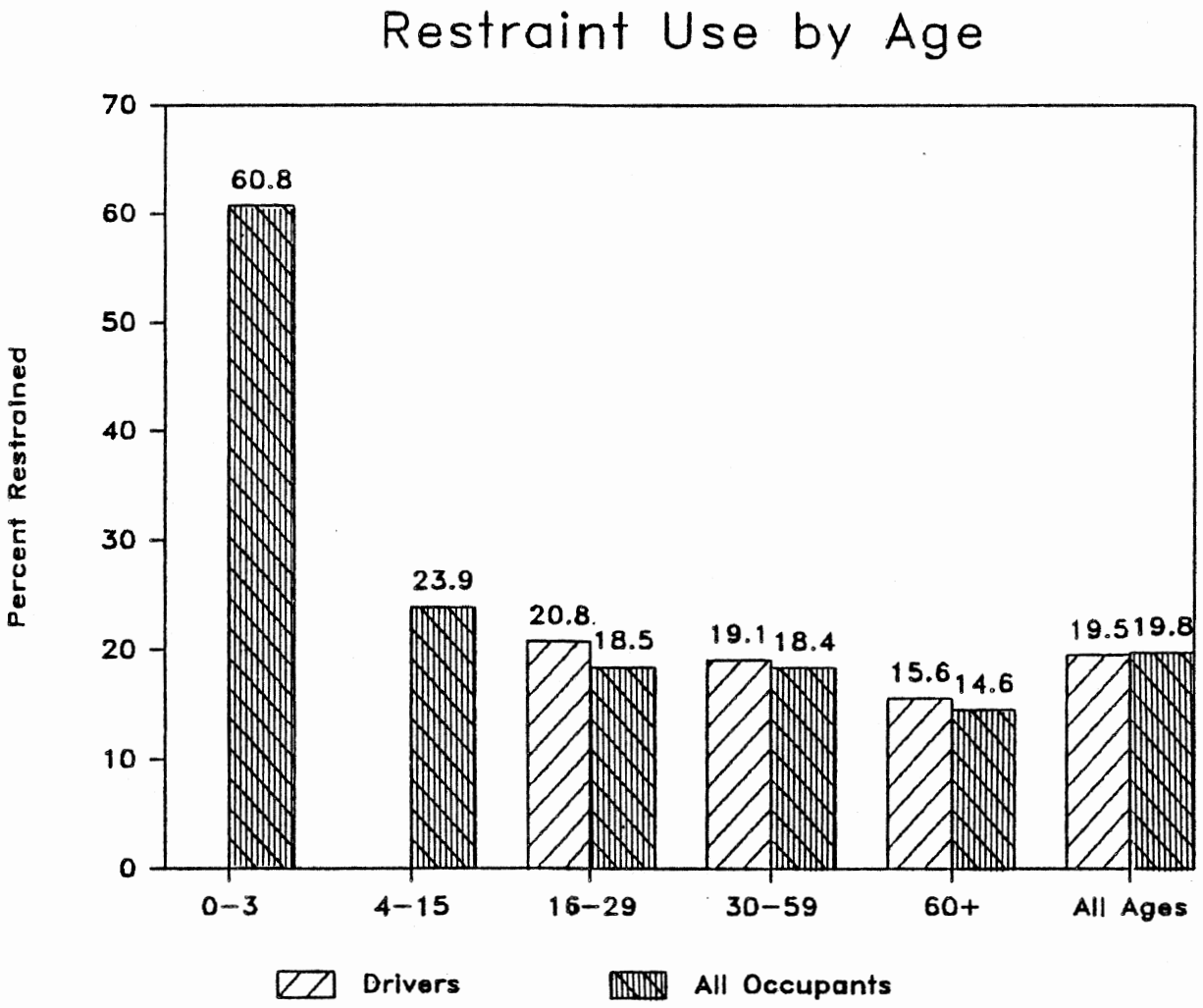

Restraint Use by Seating Position
Percent Restrained
60
50
40
30
20
10
0
19.5
20.2
17.4
35.8
25.4
30.6
54.1
DR
FC
FR
RL
RC
RR
Extra
Position

Figure 3.2


Restraint Use by Age
Percent Restrained
70
60
50
40
30
20
10
0
60.8
23.9
20.8
18.5
19.1
18.4
15.6
14.6
19.5
19.8
0-3
4-15
16-29
30-59
60+
All Ages
Drivers
All Occupants

drivers traveling with an unrestrained child would quickly fasten a seat belt around the child when they noticed the observer. Despite the relatively high rate of restraint use among young children, many toddlers were observed standing between two front bucket seats, a dangerous position if the vehicle were required to stop suddenly.

Of the 538 observed children age 0-3, 20.2% were restrained by adult seat belts and 32.4% were restrained correctly in a child restraint device (CRD). An additional 8.2% of children were restrained in a CRD, but the device was used incorrectly. The most common type of incorrect use appears to be nonuse of the CRD harness.[7] A higher proportion of CRDs are probably being used incorrectly than these estimates indicate. As discussed in Chapter 2 and Appendix D, observers were not always able to ascertain whether CRDs were properly anchored to seats or whether tether straps were used when required. Unless gross misuse was observed, correct/incorrect CRD use was determined by how the child was restrained in the seat. If the child was restrained by the CRD harness, correct use was generally assumed. Because the survey design did not permit entering the vehicle, incorrect use could not always be determined. Therefore our estimate that 20.2% of all CRDs in Michigan are used incorrectly should be considered a minimum estimate of the extent of incorrect use.

Wagenaar and Webster (1985), analyzing restraint use among crash-involved motor vehicle occupants, found that the child restraint law had a slight spillover effect on 4-15-year-olds, whose restraint use increased from 6% before to 14% after the law took effect. Results of the current direct observation study corroborate that finding: 4-15-year-olds had the second highest restraint use rate, 23.9%.[8] Restraint use among those over age 15 decreases monotonically with age: 18.5% of those age 16-29, 18.4% of those age 30-59, and 14.6% of those over 60 were wearing seat belts (Table 3.1 and Figure 3.2).

Table 3.2 displays restraint use by sex, vehicle type, observation site, and weather conditions. Females have a higher rate of restraint use than males, 21.9% versus 17.5%. However, a number of women were observed using the lap belt only in cars equipped with three-point combination lap/shoulder belts (the shoulder belt would be

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[7]However, this finding may be due in part to the coding scheme used; see Appendix D.
[8]The difference between Wagenaar and Webster's 14% estimate of restraint use among 4-15-year-olds and our estimate of 23.9% is due to two factors. First, Wagenaar and Webster report restraint use among occupants injured in crashes. Such occupants typically have lower rates of restraint use than general noncrash-involved occupants. Second, Wagenaar and Webster's data covers the period after the child restraint law from April, 1982, through December, 1983. The current survey was conducted in December, 1984, and restraint use increased from 1983 to 1984.

TABLE 3.2
Percent Restraint Use by Sex, Type of Vehicle, Type of Observation Site, and Weather Conditions[1]

	Seating Position							
	Driver	Front Center	Front Right	Rear Left	Rear Center	Rear Right	Extra Seats[2]	All[3]
Sex								
Male	17.0	23.5	16.2	32.1	20.2	31.7	26.4	17.5
Female	23.4	14.2	17.6	37.0	27.3	27.0	46.9	21.9
Type of Vehicle								
Small Car	25.3	0.0	19.3	46.1	21.8	38.4	–	27.4
Mid-Sized Car	23.9	2.6	21.7	38.1	33.0	28.4	50.0	23.9
Large Car	15.5	25.9	14.1	28.4	21.1	29.2	100.0	16.2
Pickup Truck	9.6	24.3	10.8	0.0	0.0	0.0	–	10.4
Van	15.9	21.0	23.8	35.5	42.4	21.9	46.8	19.3
Other	18.7	12.9	15.0	42.6	0.0	18.3	–	17.2
Observation Site								
Intersection	18.4	19.5	16.6	37.4	25.9	30.4	61.7	18.8
Freeway Exit	23.6	22.7	20.5	31.3	23.9	31.2	41.6	23.3
Weather Conditions								
Mostly Sunny	17.0	19.7	16.5	25.7	17.7	27.1	50.0	17.5
Mostly Cloudy	20.8	19.7	19.2	38.2	25.3	34.8	62.4	21.2
Raining	18.6	12.9	13.3	56.2	44.2	30.7	0.0	18.7
Snowing	18.6	37.2	13.5	41.4	39.6	17.6	–	18.4
TOTAL	19.5	20.2	17.4	35.8	25.4	30.6	54.1	19.8

[1]All percents are based on analyses weighted according to the sample design to accurately represent the entire state. Restraint use includes correct and incorrect use of child restraint devices.
[2]Based on only 21 observed occupants.
[3]Restraint use for all positions includes cargo areas and passengers held in laps.

positioned behind the back); this practice was not observed among males.[9] Drivers and passengers in small cars were found to use restraints (27.4%) more commonly than occupants in mid-sized (23.9%) or large cars (16.2%) (Figure 3.3). Drivers of pickup trucks had the lowest rate of restraint use (9.6%). Consistent with their drivers, pickup truck passengers riding in the front right seat had the lowest use rate for that position, 10.8%. In contrast, 24.3% of front center passengers in pickup trucks were restrained. The high use rate for the center position might be due to young children riding in that position who are required by law to be restrained. Van drivers had a relatively low use rate, 15.9%, while van passengers, particularly those riding in the rear, third, and fourth seats had surprisingly high use rates: rear left, 35.5%; rear center, 42.4%; rear right, 21.9%; and extra seats, 46.8%. However, these estimates should be interpreted with caution, since they are based on only 20 to 28 passengers in each of these positions (see Table 2.2).

The restraint use rate for drivers observed exiting freeways was 23.6%, compared with 18.4% for drivers observed at regular intersections. Front seat freeway passengers were found to use restraints more often than front seat local passengers, while the reverse was true for passengers riding in the rear left and rear center positions. The differences for rear seat passengers were small, however.

Restraint use was highest on mostly cloudy days, 21.2%, followed by 18.7% in rain, 18.4% in snow, and 17.5% in sunny weather. While it might be expected that restraint use would increase in weather that made driving seem more hazardous (i.e., snow and rain), observed differences were small.

Table 3.3 and Figures 3.4 and 3.5 display use rates by time of day and day of week. There was no consistent pattern of use by time of day. The highest use rate for both drivers and passengers was from 11 to 12 A.M. Perhaps this is due to a higher than average proportion of female drivers and a higher than average proportion of young children as passengers.

As expected, use of restraints was slightly lower on weekends than weekdays (17.9% on Saturday and 18.0% on Sunday versus 19.8% overall). However, Tuesday and Wednesday were also below average (18.7% and 18.1%). These daily differences are not significant.

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[9]Women with lap belt used, but shoulder belt placed behind their back were coded as restrained. Observers noticed this practice without any prompting by the senior project staff, and recorded it in the comments section of the vehicle form.

Figure 3.3

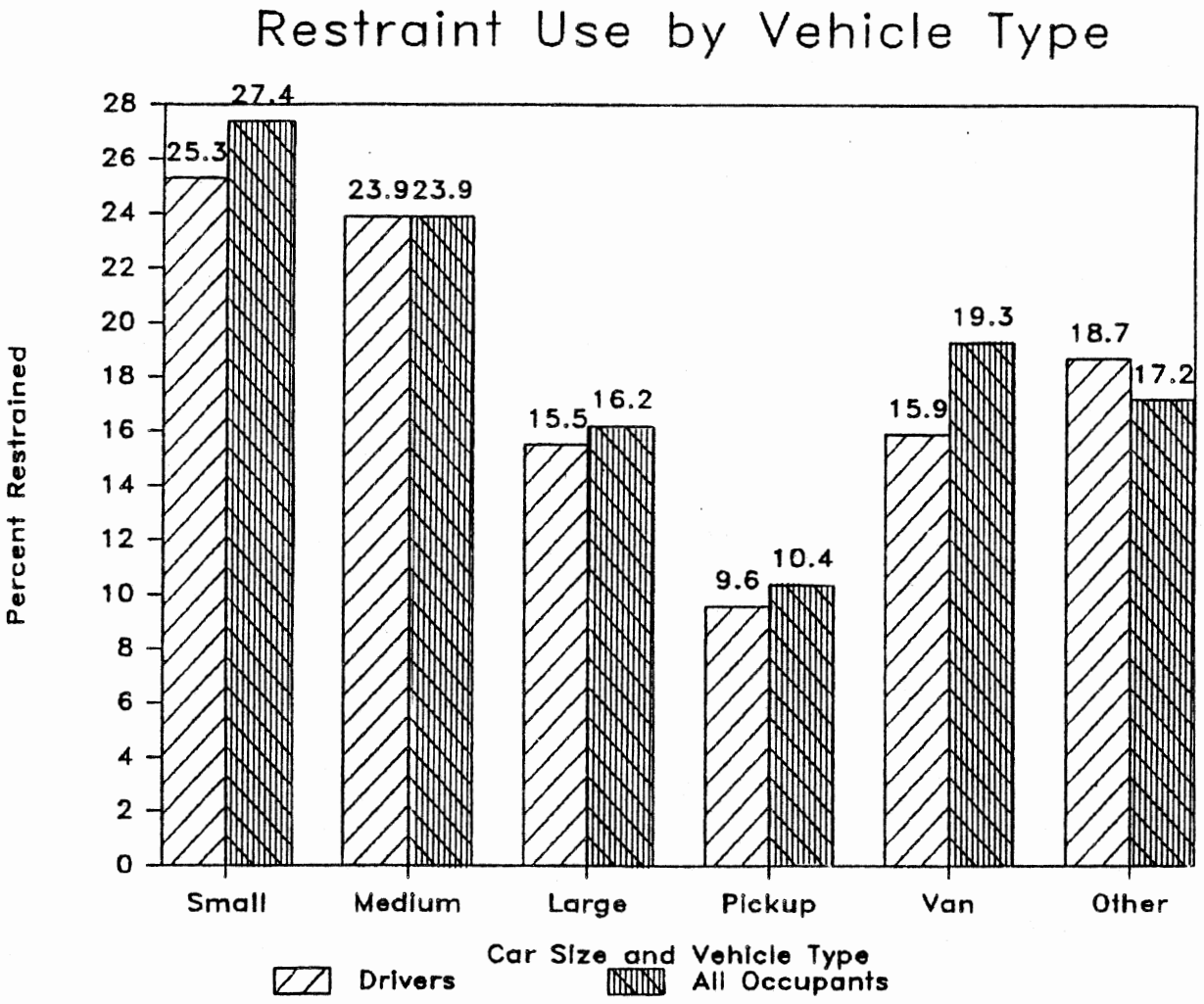

Restraint Use by Vehicle Type
Percent Restrained
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
25.3
27.4
23.9
23.9
15.5
16.2
9.6
10.4
15.9
19.3
18.7
17.2
Small
Medium
Large
Pickup
Van
Other
Car Size and Vehicle Type
Drivers
All Occupants

TABLE 3.3
Percent Restraint Use by Time of Day and Day of Week[1]

	Seating Position							
	Driver	Front Center	Front Right	Rear Left	Rear Center	Rear Right	Extra Seats[2]	All[3]
Time of Day								
8-9 AM	19.6	3.0	17.3	34.2	21.2	29.2	100.0	19.7
9-10 AM	18.0	21.4	19.8	47.2	32.9	42.3	30.0	20.3
10-11 AM	16.5	23.4	14.4	37.5	20.4	22.4	0.0	16.6
11-12 AM	21.2	29.5	18.8	46.9	30.3	35.9	0.0	21.8
12-1 PM	19.9	12.1	17.2	30.5	20.8	22.4	100.0	19.6
1-2 PM	20.2	11.7	15.9	31.8	27.3	23.0	0.0	19.4
2-3 PM	20.6	20.2	18.0	31.9	32.1	33.9	100.0	21.0
3-4 PM	20.8	30.0	17.6	17.7	4.9	33.4	0.0	20.1
4-5 PM	17.1	16.0	18.8	27.9	29.3	29.9	0.0	18.1
5-6 PM	28.6	–	0.0	100.0	–	–	–	27.8
Day of Week								
Monday	23.6	13.1	19.4	33.0	14.6	41.8	0.0	23.0
Tuesday	18.0	28.2	15.5	41.3	42.8	36.2	0.0	18.7
Wednesday	17.9	20.0	13.9	50.2	35.0	27.2	40.0	18.1
Thursday	23.2	41.7	19.4	59.8	38.6	43.0	0.0	23.9
Friday	22.0	34.6	16.5	49.8	36.0	36.2	100.0	21.8
Saturday	17.0	21.6	18.6	27.6	15.5	22.1	85.1	17.9
Sunday	16.9	6.0	17.7	26.8	23.8	28.5	63.8	18.0
TOTAL	19.5	20.2	17.4	35.8	25.4	30.6	54.1	19.8

[1]All percents are based on analyses weighted according to the sample design to accurately represent the entire state. Restraint use includes correct and incorrect use of child restraint devices.
[2]Based on only 21 observed occupants.
[3]Restraint use for all positions includes cargo areas and passengers held in laps.

Figure 3.4

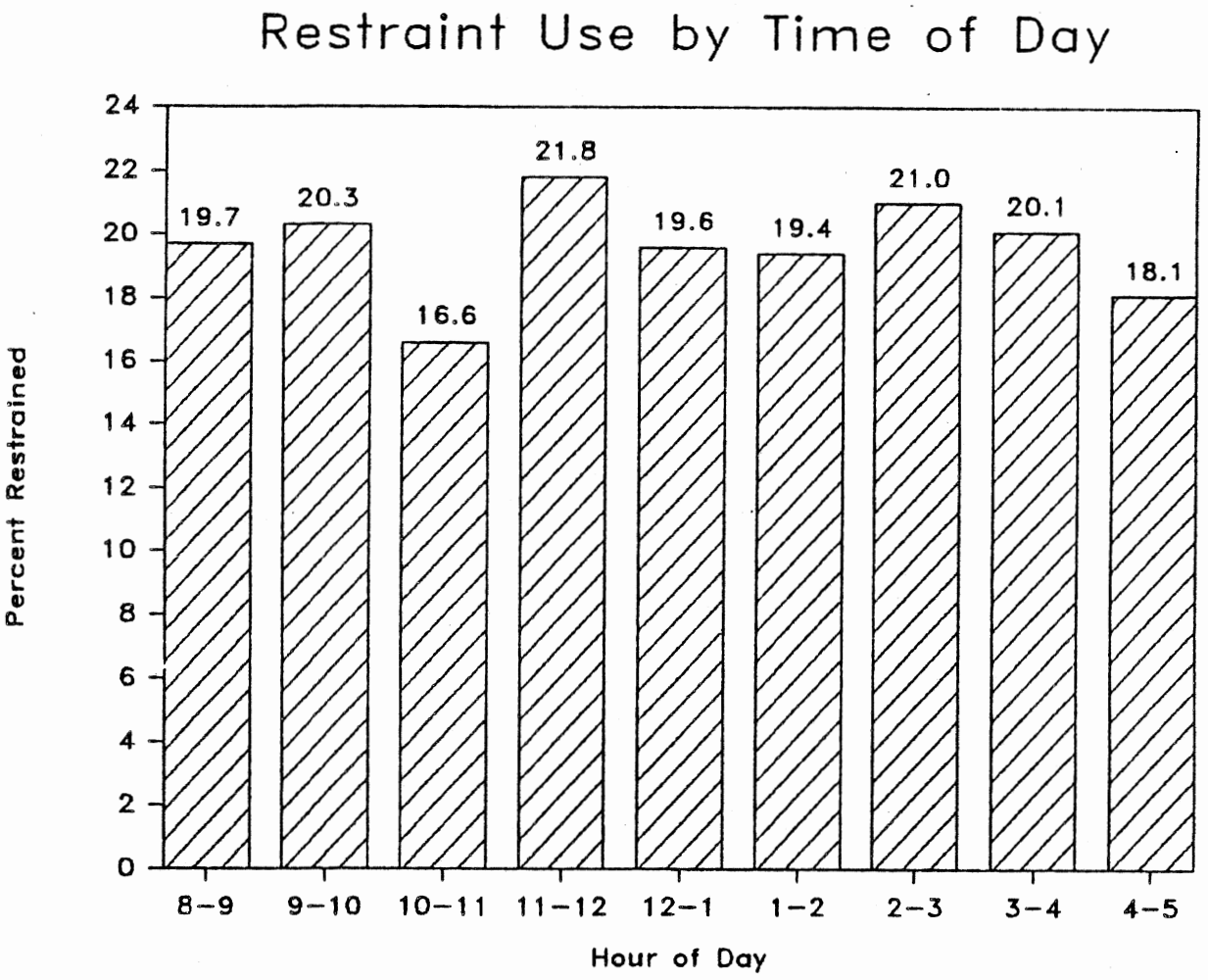
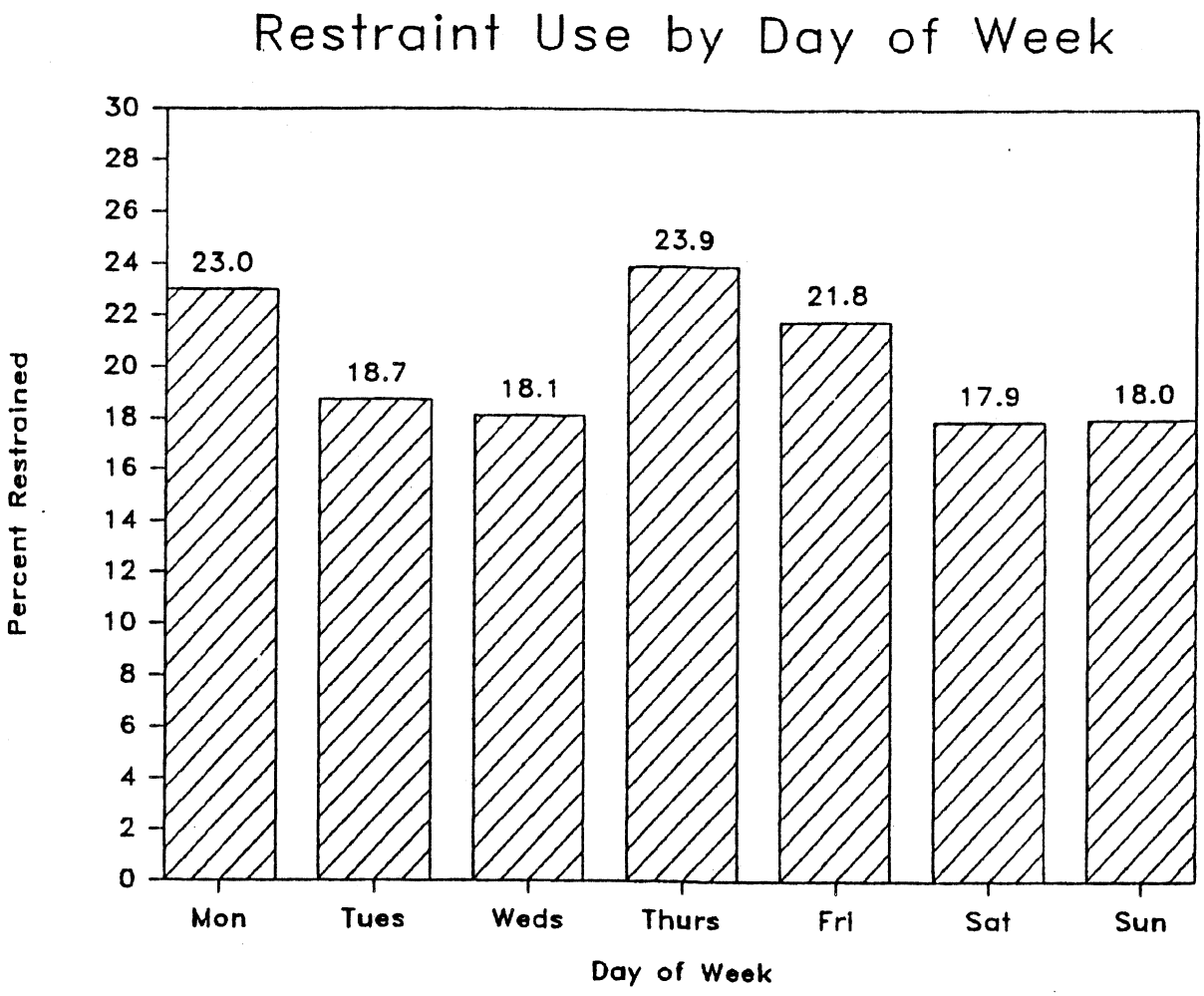

Restraint Use by Time of Day
Percent Restrained
0
2
4
6
8
10
12
14
16
18
20
22
24
19.7
20.3
16.6
21.8
19.6
19.4
21.0
20.1
18.1
8-9
9-10
10-11
11-12
12-1
1-2
2-3
3-4
4-5
Hour of Day

Figure 3.5


Restraint Use by Day of Week
Percent Restrained
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
23.0
18.7
18.1
23.9
21.8
17.9
18.0
Mon
Tues
Weds
Thurs
Fri
Sat
Sun
Day of Week

Restraint use by region varies significantly (Tables 3.4 and 3.5 and Figure 3.6; see Appendix G for map of regions). The Southeast region (which includes Ingham and Washtenaw counties) had the highest use rate of 24.3%; the East Central region was second with 23.8%. The region with the lowest restraint use rate, 14.5%, was Eastern Upper Peninsula. To help understand observed regional differences in restraint use, educational attainment and poverty levels for the three regions were examined.[10] In the Southeastern region 74.1% of the population over 25 years of age completed high school and 21.2% completed college. Washtenaw county has the highest proportion of high school and college graduates in the state (80.9% and 36.0%). Ingham county residents also have high educational attainment, with 77.9% completing high school and 25.9% graduating from college. In contrast, only 66.3% of residents in the East Central and 64.9% of residents in the Eastern Upper Peninsula region completed high school; the corresponding figures for completion of college are 10.7% and 10.1%. Despite large discrepancies in educational attainment between the Southeast and East Central regions, differences in restraint use are relatively small. At the same time, differences in educational attainment between the East Central and Eastern U.P. are small, while restraint use differs greatly. Figures for the proportion of the population below the poverty level are as follows: 10.1% in Southeastern Michigan, 10.3% in East Central, and 14.5% in the Eastern Upper Peninsula. Thus, the Eastern Upper Peninsula region is characterized by both low educational levels and high rates of poverty, which may partially explain the low rates of restraint use.

Restraint use varied considerably by sampling area, and indicated more clearly the relationship between restraint use and socioeconomic status (Table 3.5). Detroit and Melvindale had the lowest rates of restraint use, 9.8%. Other areas with particularly low rates of restraint use were Berrien County (12.8%); Delta County (10.2%); Dickinson County (13.7%); Mecosta-Newaygo Counties (12.5%); Muskegon County (14.2%); St. Clair County (12.6%); Wayne County, City of Trenton (14.2%); and Wayne County, City of Wyandotte (11.6%). Most of these are lower socio-economic status areas.

The highest rates of restraint use were found in Eaton County (28.9%); Grand Traverse County (38.7%); Ingham County (31.2%); Ingham County, City of East Lansing (32.5%); Kalamazoo County, City of Kalamazoo (26.6%); Kent County (31.4%); Oakland County (29.2%); and Washtenaw County, City of Ann Arbor (34.8%). These areas with

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[10] Information on Michigan education and poverty levels was obtained from the *Michigan Statistical Abstract, Eighteenth Edition, 1984*, and is based on the 1980 census. Previous research has indicated varying restraint use according to educational attainment and income level (Pless and Roghmann, 1978).

TABLE 3.4
Percent Restraint Use by Michigan Department of Transportation Regions[1]

MDOT Region	Seating Position							
	Driver	Front Center	Front Right	Rear Left	Rear Center	Rear Right	Extra Seats[2]	All[3]
1. Western U.P.	16.8	14.4	14.4	31.4	31.8	26.4	0.0	17.1
2. Eastern U.P.	12.8	27.3	16.3	17.7	23.4	19.9	–	14.5
3. Northwest	24.4	10.0	19.7	35.0	56.3	32.0	–	23.7
4. Northeast	24.1	24.1	21.7	12.3	39.9	13.1	0.0	23.0
5. West Central	17.8	26.9	17.4	55.5	17.5	54.8	100.0	19.6
6. East Central	24.8	16.5	20.2	30.7	24.7	28.5	50.0	23.8
7. Southwest	19.0	25.4	18.1	55.1	30.3	55.4	–	20.5
8. Southeast	24.5	30.8	21.8	40.0	24.6	26.5	100.0	24.3
Metro Detroit	17.1	11.6	15.3	29.8	23.3	23.7	48.6	17.3
TOTAL	19.5	20.2	17.4	35.8	25.4	30.6	54.1	19.8

[1]All percents are based on analyses weighted according to the sample design to accurately represent the entire state. Restraint use includes correct and incorrect use of child restraint devices.
[2]Based on only 21 observed occupants.
[3]Restraint use for all positions includes cargo areas and passengers held in laps.

Figure 3.6

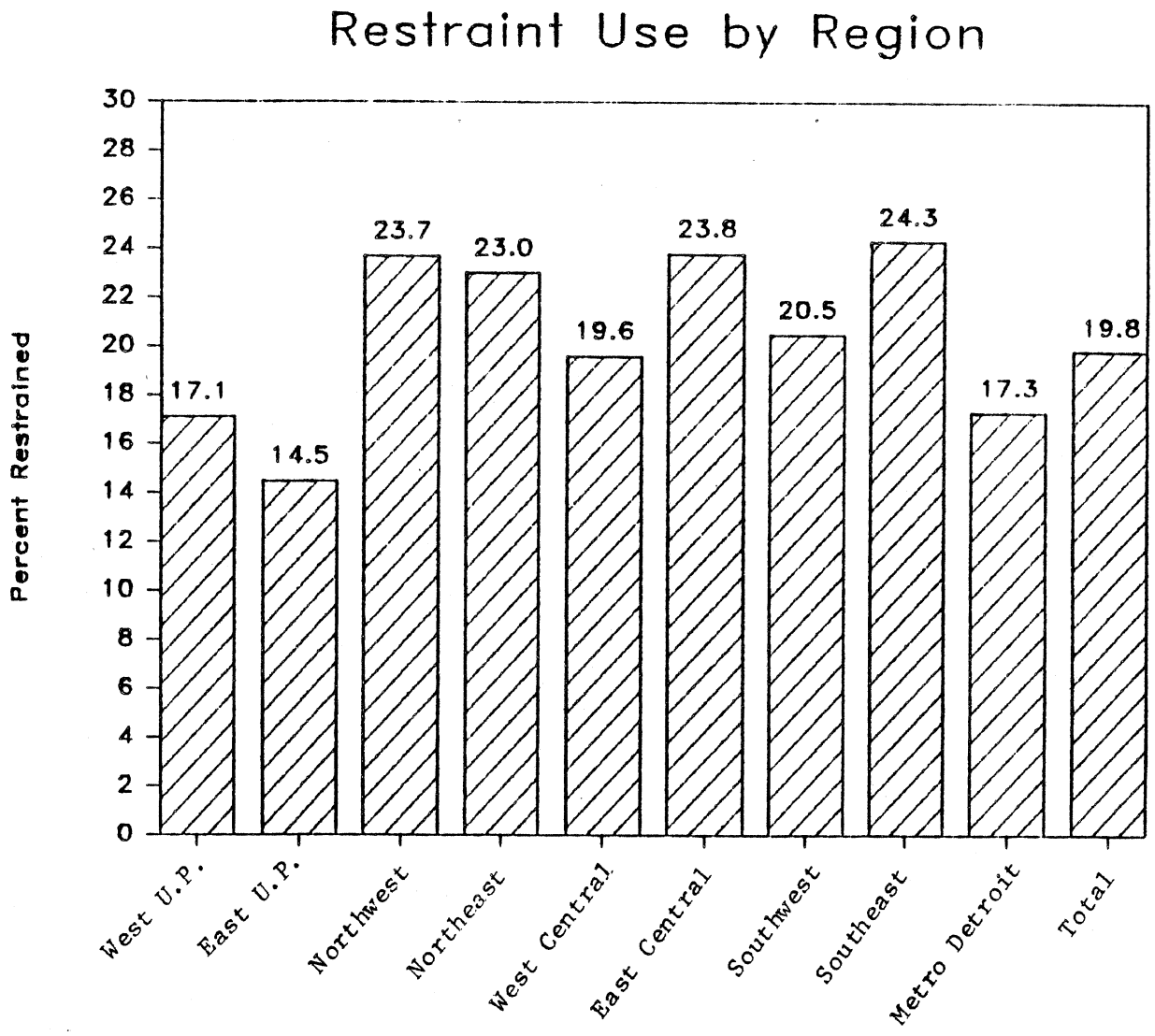
Restraint Use by Region
Percent Restrained
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
17.1
14.5
23.7
23.0
19.6
23.8
20.5
24.3
17.3
19.8
West U.P.
East U.P.
Northwest
Northeast
West Central
East Central
Southwest
Southeast
Metro Detroit
Total

TABLE 3.5
Restraint Use, Number of Vehicles Observed, and Number of Occupants Observed for Each Sampling Area[1]

Sampling Area	Number of Vehicles Observed	Number of Occupants Observed	Percent Drivers Restrained	Percent Passengers Restrained[2]	Percent All Occupants Restrained[2]
Barry[3]	204	284	19.2	26.3	21.1
Bay	201	276	25.7	13.5	22.4
Berrien County	163	274	8.7	19.4	12.8
Berrien, Niles	198	349	14.7	21.3	17.4
Charlevoix	204	372	16.7	21.2	18.7
Chippewa	186	306	15.1	22.5	18.1
Crawford-Roscommon	204	303	24.6	24.7	24.7
Delta	202	286	10.4	9.6	10.2
Dickinson	195	277	11.7	18.9	13.7
Eaton	204	273	26.0	37.9	28.9
Genesee	611	863	25.7	22.7	24.8
Grand Traverse	204	271	39.7	35.4	38.7
Ingham County	204	264	31.7	29.3	31.2
Ingham, East Lansing	204	269	28.9	43.8	32.5
Iosco-Alcona	197	295	23.6	17.1	21.5
Jackson	198	289	14.8	21.9	17.0
Kalamazoo County	195	256	20.0	26.3	21.5
Kalamazoo City	203	270	25.4	30.3	26.6
Kent County	204	279	27.5	42.9	31.4
Kent, Grand Rapids	204	275	18.7	20.3	19.1
Kent, Wyoming	204	285	14.3	26.3	17.6
Lapeer	204	257	24.5	21.6	23.9
Lenawee[3]	202	302	17.2	15.9	16.8
Macomb	610	783	18.3	13.8	17.4
Marquette	408	579	19.4	17.2	18.7
Mason	204	286	16.7	14.3	16.1
Mecosta-Newaygo	204	297	12.3	13.2	12.5
Monroe[3]	188	295	16.3	15.1	15.8
Montcalm[3]	186	365	19.5	20.4	19.9
Muskegon	180	236	13.2	17.5	14.2
Oakland County	984	1,505	27.4	32.9	29.2
Oakland, Royal Oak	204	289	24.8	23.4	24.4
Ottawa	204	297	19.2	27.5	21.8
Saginaw	374	634	22.8	22.9	22.8
St. Clair	200	270	8.1	25.9	12.6
VanBuren	144	228	18.8	17.0	18.1
Washtenaw, Ann Arbor	204	266	36.9	27.9	34.8
Wayne, Detroit	1,395	2,212	10.0	9.4	9.8
Wayne, Canton	204	346	23.2	25.6	24.1
Wayne, Garden City	203	305	19.3	11.7	16.8
Wayne, Livonia	204	253	20.3	23.4	20.9
Wayne, Melvindale etc.	204	340	8.9	11.3	9.8
Wayne, Trenton etc.	204	300	13.4	16.1	14.2
Wayne, Wyandotte	203	307	12.1	10.4	11.6
TOTAL	11,906	17,568	19.5	20.4	19.8

[1]All percentages are based on weighted analyses.
[2]Includes correct and incorrect use of child restraint devices.
[3]For these sampling areas no signalized freeway exits existed. Therefore, freeway exits required by the sample design were selected from an adjacent county.

high rates of restraint use are generally higher socio-economic status areas.[11]

3.2 Sampling Errors

Calculation of exact sampling errors and confidence intervals for multi-stage stratified sample designs like that used in this survey is generally very complex (Kish, 1965). In the current survey, sampling error is introduced at each stage of the sample: selection of PSUs within each region, selection of intersections within each PSU, and selection of vehicles at each intersection. In some PSUs an additional stage involved selection of districts prior to selection of specific intersections. Each stage in a multi-stage sample contributes sampling error, typically making the total sampling error considerably larger than a simple random sample. Furthermore, each stage in the current sample design, other than selection of intersections and vehicles, included stratification, which reduced sampling error.

Simplifying assumptions were made to determine the approximate sampling error for the estimate of overall restraint use, and to obtain some indication of the *design effect* of the sampling strategy employed. First, all stratification procedures employed were ignored when calculating the sampling error. This had the effect of **over**estimating sampling error, and **under**estimating the precision of the results. Second, the contribution of each sampling stage to the total sampling error was not calculated separately. An approximation suggested by Moser and Kalton (1971:202) was used instead. An estimate of the sampling error was based on the variation **between** PSUs, obviating the need to calculate the variation **within** each PSU. Hansen, Hurwitz, and Madow (1953) refer to this as the ultimate cluster approach.

Using this approach, the approximate sampling error for the estimate of 19.5% of drivers restrained was calculated. Results produced an estimated standard error of 1.1%. In other words, we are 95% confident that the true driver restraint use rate in Michigan is between 17.3% and 21.7% (19.5 plus or minus two standard errors).

The estimated sampling variance based on the ultimate cluster approach was compared with the estimated variance for a simple random sample of the same size. Results indicated that the design effect for the multi-stage stratified sample used was about nine. Therefore, an approximate estimate of the standard error for the proportions reported in section 3.1 could be obtained by multiplying the simple random sample

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[11] Major programs promoting the use of restraint systems have been implemented in Grand Traverse, Kalamazoo, and Washtenaw counties.

estimate of the standard error by three, the square root of the design effect.[12]

3.3 Relationship of Driver to Passenger Restraint Use

Many studies have found that passengers traveling with restrained drivers are more likely to be restrained than passengers traveling with unrestrained drivers. Data from the current survey clearly demonstrate this relationship: 71.5% of passengers traveling with belted drivers were themselves restrained, while only 9.7% of passengers traveling with an unbelted driver were restrained (Table 3.6). This relationship held for passengers of all ages and in both the front and rear seats. The effects of Michigan's child restraint law can also be seen in Table 3.6. Even among drivers who were not belted, 59.7% restrained the young child they were transporting. In contrast to those covered by the child restraint law, only 11.5% of 4-15-year-olds traveling with unbelted drivers were restrained.

3.4 Changes in Restraint Use--August 1983 versus December 1984

Results of the current survey clearly indicate that use of restraint systems has increased in Michigan in the past year and a half, since O'Day and Wolfe (1984) conducted their survey. They found 14.4% of drivers and 13.8% of all occupants to be restrained in a survey using the same sample design as used here. However, the earlier survey missed 24 of the 240 intersections selected into the sample. O'Day and Wolfe reweighted the intersections observed to take into account the missed sites; however, the intersections not observed were not a random sample from the total 240 intersections. In particular, most of the unobserved sites were in central Detroit.

To estimate the effect of the missed sites in the O'Day and Wolfe survey, data from the current survey were analyzed with the same procedures used by O'Day and Wolfe, and compared with the results from all 240 sites observed in the current survey (Table 3.7). Results of the current survey, based on all 240 sites, indicate that 19.5% of drivers and 19.8% of all occupants were restrained. The corresponding figures are 20.6% for drivers and 21.2% for all occupants if the 24 sites missed in 1983 are excluded, and remaining sites are reweighted using the procedure of O'Day and Wolfe. Therefore, if the present survey missed the same sites as had been missed by O'Day and Wolfe, the results would have **over**estimated restraint use by 1.1 percentage points

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[12]While it is common practice to apply the design effect calculated on the basis of the total sample to subgroups within the sample, it is important to note that the design effect can vary across such subgroups.

TABLE 3.6
Passenger Restraint Use by Age by Driver Restraint Use[1]

	Passenger Seating Position		Total Passengers
	Front Seats	Rear Seats	
Driver Restrained			
Passengers 0-3			
% Restrained	100.0	93.6	95.5
Unweighted N	35	85	120
Passengers 4-15			
% Restrained	89.7	67.4	76.3
Unweighted N	83	123	206
Passengers 16-29			
% Restrained	68.0	31.5	63.1
Unweighted N	176	25	201
Passengers 30-59			
% Restrained	73.7	38.7	70.6
Unweighted N	234	20	254
Passengers 60+			
% Restrained	52.9	34.4	51.2
Unweighted N	98	12	110
Total Passengers			
% Restrained	72.8	68.6	71.5
Unweighted N	626	265	891
Driver Not Restrained			
Passengers 0-3			
% Restrained	52.0	64.9	59.7
Unweighted N	125	187	312
Passengers 4-15			
% Restrained	10.7	12.3	11.5
Unweighted N	449	465	914
Passengers 16-29			
% Restrained	2.6	2.2	2.6
Unweighted N	1066	136	1202
Passengers 30-59			
% Restrained	5.3	1.2	5.0
Unweighted N	1294	87	1381
Passengers 60+			
% Restrained	4.8	0.0	4.3
Unweighted N	439	62	501
Total Passengers			
% Restrained	6.9	19.7	9.7
Unweighted N	3373	937	4310

[1]All percents are based on analyses weighted according to the sample design to accurately represent the entire state. Restraint use includes correct and incorrect use of child restraint devices. Unweighted Ns indicate the actual number of occupants observed in each group. This table excludes 157 occupants in non-standard seats (third or fourth seats, cargo areas, riding on the lap of another passenger, or doubled in one seat position).

TABLE 3.7
Comparison of Current Restraint Use with 1983 O'Day-Wolfe Survey, in Weighted Percent

Sampling Areas with Missed Sites in 1983	December 1984 All 240 Sites	December 1984 Without 24 Sites Missed in 1983	August 1983 At the 216 Observed Sites
Genesee (2 of 12 missed)			
Drivers	25.7	26.0	13.6
All Occupants[1]	24.8	25.7	12.7
Grand Traverse (1 of 4 missed)			
Drivers	39.7	37.9	18.6
All Occupants	38.7	37.4	20.4
Mason (1 of 4 missed)			
Drivers	16.7	13.8	6.8
All Occupants	16.1	13.0	8.4
Wayne, Detroit (20 of 28 missed)			
Drivers	10.0	14.5	10.5
All Occupants	9.8	15.3	10.1
TOTAL			
Drivers	19.5	20.6	14.4
All Occupants	19.8	21.2	13.8

[1]Restraint use for all occupants includes correct and incorrect use of child restraint devices.

for drivers and 1.4 percentage points for all occupants. Based on this finding, it appears that the O'Day and Wolfe results **over**estimated restraint use in 1983. Adjusting the 1983 results for the bias due to missing sites that had a much lower than average restraint use produces an estimate of restraint use in 1983 of 13.6% for drivers and 12.9% for all occupants. Comparison of these adjusted 1983 figures with the results of this survey reveal a substantial 5.9 percentage-point increase in driver restraint use and 6.9 percentage-point increase in restraint use among all occupants. Given the approximate sampling error of 1.1% for estimated restraint use from the current survey, the increases in restraint use from August/September 1983 to December 1984 are clearly statistically significant.[13]

3.5 Conclusion

Results of this survey document increased restraint use in Michigan in recent years. These findings based on direct observation of motorists corroborate the increases in restraint use seen among crash-involved occupants (reported in Wagenaar and Webster, 1985). The most important use of these results is as a baseline from which to measure the effects of Michigan's adult restraint law, which takes effect in July, 1985. We currently plan to repeat this survey, using the same sample design and data collection procedures, in the spring of 1985, immediately before the adult seat belt law is implemented, in the summer of 1985, immediately after the law takes effect, and in the fall of 1985, after the law has been in effect for several months. Further survey waves are planned for 1986 and 1987, to continue monitoring the effects of the law and other efforts to increase restraint use in Michigan.

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[13]Approximate standard errors based on the multi-stage sample design were not provided by O'Day and Wolfe, but they are expected to be similar to those of the current study.

Chapter 4

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Appendix A

VEHICLE FORM

DUP COL 1-4

DRIVER	FRONT CENTER	FRONT RIGHT	REAR LEFT	REAR CENTER	REAR RIGHT
1[ ] No Rstrt	1[ ] No Rstrt	1[ ] No Rstrt	1[ ] No Rstrt	1[ ] No Rstrt	1[ ] No Rstrt
2[ ] Belted	2[ ] Belted	2[ ] Belted	2[ ] Belted	2[ ] Belted	2[ ] Belted
3[ ] CRD OK	3[ ] CRD OK	3[ ] CRD OK	3[ ] CRD OK	3[ ] CRD OK	3[ ] CRD OK
4[ ] CRD Wrong 5	4[ ] CRD Wrong 6	4[ ] CRD Wrong 7	4[ ] CRD Wrong 8	4[ ] CRD Wrong 9	4[ ] CRD Wrong 10
1[ ] Male	1[ ] Male	1[ ] Male	1[ ] Male	1[ ] Male	1[ ] Male
2[ ] Female 11	2[ ] Female 12	2[ ] Female 13	2[ ] Female 14	2[ ] Female 15	2[ ] Female 16
1[ ] 0-3	1[ ] 0-3	1[ ] 0-3	1[ ] 0-3	1[ ] 0-3	1[ ] 0-3
2[ ] 4-15	2[ ] 4-15	2[ ] 4-15	2[ ] 4-15	2[ ] 4-15	2[ ] 4-15
3[ ] 16-29	3[ ] 16-29	3[ ] 16-29	3[ ] 16-29	3[ ] 16-29	3[ ] 16-29
4[ ] 30-59	4[ ] 30-59	4[ ] 30-59	4[ ] 30-59	4[ ] 30-59	4[ ] 30-59
5[ ] 60+ 17	5[ ] 60+ 18	5[ ] 60+ 19	5[ ] 60+ 20	5[ ] 60+ 21	5[ ] 60+ 22

VEHICLE SIZE/TYPE

1[ ] Small car
2[ ] Medium car
3[ ] Large car
4[ ] Pickup
5[ ] Van
6[ ] Other_____
23

ID # ___ ___ 24 25

COMMENTS: Any young children in lap? Any other occupants?

Reduced to 74% of original size.

Appendix B

SITE FORM

SITE DESCRIPTION

SITE # ___ (1 2 3) Site Location _____

SITE TYPE: 1[ ] Intersection (4)
2[ ] Freeway exit

SITE CHOICE: 1[ ] Choice A
2[ ] Choice B (5)

DATE (month/day): ___ (6 7) / ___ (8 9) / 1984

START TIME: ___ (10 11) : ___ (12 13) 1[ ] AM
2[ ] PM (14)

OBSERVER (15)
1[ ] Karen
2[ ] Ron
3[ ] Meg
4[ ] Chuck
5[ ] Art
6[ ] Alex

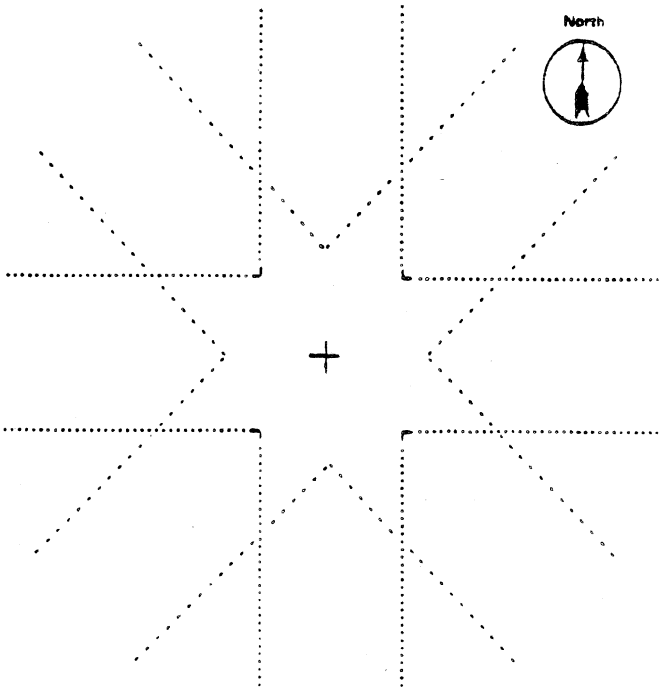
DAY OF WEEK (16)
1[ ] Monday
2[ ] Tuesday
3[ ] Wednesday
4[ ] Thursday
5[ ] Friday
6[ ] Saturday
7[ ] Sunday

WEATHER (17)
1[ ] Mostly Sunny
2[ ] Mostly Cloudy
3[ ] Rain
4[ ] Snow

BREAK TIME (total number of minutes during observation period): ___ (18 19)

END TIME: ___ (20 21) : ___ (22 23) 1[ ] AM
2[ ] PM (24)

COMMENTS:



Appendix C

DAILY TRAVEL RECORD

DAILY TRAVEL RECORD

DATE (month/day): __ __ / __ __ / 1984

NAME: _____

Start Location: _____

Start Time: __ : __ AM PM

Destination	Arrival Time	Departure Time

EXPENSES: Breakfast $_____

Lunch $_____

Dinner $_____

Lodging $_____ Save Receipts.

Gasoline $_____ Save Receipts.

Other $_____ Save Receipts.

Appendix D

INSTRUCTIONS FOR FIELD OBSERVERS

The purpose of the study is to obtain an accurate estimate of seat belt and child restraint use among motor vehicle occupants throughout the State of Michigan. Vehicles at a carefully selected set of roadway intersections will be observed at particular times of the day and days of the week. Local police agencies have been notified by letter that we will be observing restraint use at these sites. In the event a police officer stops to question you, explain your presence briefly, and show the officer a copy of the letter of support from the Office of Highway Safety Planning of the Michigan State Police (see Appendix E). You are to wear an orange safety vest when observing vehicles.

Observation Sites

You have been provided a list of road intersections to observe, with the day and time for observation also indicated. All intersections assigned have either a traffic light or a stop sign to permit observation of vehicle occupants while the vehicle is stopped. You must observe vehicles at the particular sites assigned, and not at any other sites. In the unlikely event that after arriving at an assigned site you determine that it is impossible to observe restraint use at that site (due to construction, for example), you should consult the site card file, locate the card for your assigned site, and use the alternate site listed on that card. Proceed directly to the alternate site, which will be located close to the primary site, to maintain the original time schedule as much as possible. Always record on the Site Description Form which site was observed, any unusual features of the site, or problems you had at the site. If an alternative site is used, record the reason the original site could not be used. In the extremely unlikely event both the original and alternate sites cannot be used, record why on the site observation form and move on to the next regularly scheduled site.

Time of Observations

It is important that the specific sites you have been assigned for observation be observed at the particular time scheduled. However, to take into account differing weather conditions, driving time, etc., you are allowed to deviate from the assigned time to start observing a particular site by 15 minutes. You may begin observing a site

scheduled for 11:00 A.M.. therefore, anytime from 10:45 to 11:15 A.M. If conditions beyond your control prevent maintaining the exact schedule assigned. the sites should still be observed, always recording the **actual** time the observations were started and ended on the site description form.

On each day that you begin observing at 9:45, note the weather conditions during your lunch hour. If conditions are sunny, add one-half hour to your lunch break. Each site in the afternoon should then be started one-half hour later than the assigned time (with the last site therefore being completed at 5:00 in the east or 5:15 in the west, one-half hour later than the normal 4:30 in the east or 4:45 in the west). The purpose is to obtain observations later in the day on those days in which sunny conditions provide sufficient light for accurate observation late in the day.

Procedures upon Arriving at a Site

When you arrive at an assigned site, fill out the Site Description form, through the Day of Week item. Check boxes on all the forms with a horizontal line through the box. After seeing the site, select the best location to stand for observing vehicle occupants stopped at the light. You will generally observe vehicles in the right lane but you should observe traffic in left lanes if the site allows it (such as freeway exit intersections and one-way streets). Choose the street with enough traffic that cars line up for a red light. A very busy street, however, is not always the best choice, because the light is green for a very long time for traffic on the major road, and it is difficult to obtain observations on sufficient vehicles within the 45 minutes allotted to each site. Write the two street names on the road diagram at the lower right corner of the form. Then indicate with an X the location from which you observed vehicles. If you switch to a different standing place during the observation time, indicate time of change and the second location used. After all observations are made for the particular site, return to the Site Description Form to record weather conditions during observations, ending time, and number of minutes of break time during observations (if any). Break time refers to time during the observation start and end times that you were not observing vehicles or directly waiting for vehicles to stop. Finally, record any unusual events or situations on the form in the comments section.

Attached to each Site Description Form are 17 sheets of Vehicle Observation Forms, with room to record occupants of 51 vehicles. Upon a red light, begin recording with

the **second** vehicle stopped if more than one vehicle is stopped, and record information for all vehicle occupants for as many vehicles as possible until the light changes to green and traffic begins to move. Medium and large trucks, motorhomes, and buses should be excluded, but include pickup trucks, vans, utility vehicles, and truck-based station wagons. If only one vehicle is stopped when the light turns red, start observing that vehicle.

All of the items on the Vehicle Observation Form should be filled out for all occupants of the observed vehicle in the six main seating positions. Most items on the form are self-explanatory. However, the definition of the restraint item may not be clear. "No restrt" means the occupant was not restrained by either a shoulder belt, a lap belt, or a child restraint device. "Belted" occupants have a shoulder and/or lap belt on. "CRD Ok" and "CRD Wrong" apply to young children seated in a child restraint device. A young child seated in a rear-facing infant seat is to be coded "CRD Ok" if the adult lap belt is fastened over the infant seat. Because frequently it will be impossible to observe, do not worry about whether or not the infant seat harness is over the child. If an infant seat is positioned forward-facing, code the child as "CRD Wrong." Toddlers in convertible or toddler child seats are coded as "CRD Ok" if the child seat harness is fastened over the child; if the harness is **not** fastened, code as "CRD Wrong." Do not worry about whether the toddler seat is correctly fastened to the vehicle via the adult lap belt, since the correctness of seat installation will usually be impossible to accurately observe from outside the vehicle. If a toddler is in a booster seat **with** a tethered harness fastened over the child, code as "CRD Ok." A child in a booster seat with adult lap belt fastened but no tethered harness (and no shield) is coded "Belted." A child in a booster seat without a lap belt fastened is coded "No Rstrt." A child in a booster seat **with** a shield **and** with lap belt fastened is coded "CRD Ok." A child in a booster seat with a shield but **without** a lap belt fastened is coded "No Rstrt." These examples should cover most situations. However, if you have any uncertainty when coding children riding in restraints, or if you come upon any unusual situations, record the actual use configuration in the comments section of the Vehicle Observation Form.

Restraint use is the most important item, but it may be impossible to observe for certain occupants (particularly in rear seats, where the lap belt must be observed). If you cannot determine restraint use for an occupant, leave that item blank but make sure to check at least the sex or age item so that we know that an occupant was in that position. In addition, note in the comments section whether there were other occupants, not in the six main positions. For example, a child in the lap of a person seated in a main position should be noted. The person holding the child would be

recorded under front-right. if that is where they were, and the child should be noted as present in front-right lap. A second example is occupants in the back of a station wagon or pickup truck, or in the third or fourth seats of a van. The most important information for these other occupants is to record the number of them present in the vehicle. You should also record their estimated age. Sex of these non-standard position occupants need not be recorded. Finally, ignore the item on the Vehicle Observation Form labeled "ID #."

After you observe and record 51 vehicles at a particular site (i.e., all sheets filled), stop observing at that site, and proceed to the next assigned site. If you have not recorded 51 vehicles by the end of the allotted 45 minute time period, you may use your discretion and stay up to 15 minutes longer at the site to obtain additional vehicles, especially if it is not far to the next site. If you are ahead of schedule for that day, you would be likely to stay longer to obtain additional vehicles. On the other hand, if you are behind schedule already, you would not stay past the 45 minute time allotment. The card file of site information may also be consulted in planning one's schedule. The card for each site includes the distance to the next site.

Other Issues

Please call collect 313-763-2465 between 8 A.M. and 5:00 P.M. if you come upon any unusual situations or if you have any questions at all. Please call in after the first day or two of observations, regardless. Thereafter, call in to the office least every Friday. We would like to keep in contact concerning your progress. If you have questions in the evening or on weekends, please call Alex at home (313-xxx-xxxx).

A daily log sheet has also been provided for you to record the start and end times of your observation periods. The time logs will simply be used for planning additional similar surveys in the future. Also on the daily log sheet is a place for you to record your expenses for the day. Please keep accurate records of expenses incurred, and receipts will be required for all expenses except meals. The project budget provides for up to $30 per night for those nights in which lodging is necessary. Your assistance in keeping travel expenses within budget is greatly appreciated.

Finally, you will be visited on a random basis at particular sites by one of the project senior staff.

Appendix E

LETTER OF SUPPORT

OFFICE OF HIGHWAY SAFETY
PLANNING
LOWER LEVEL
111 S. CAPITOL AVENUE
LANSING, MICHIGAN 48913
PHONE 517 [illegible]

November 20, 1984

TO WHOM IT MAY CONCERN:

The University of Michigan Transportation Research Institute is conducting an observation study of seat belt and child restraint use by Michigan motorists at a representative sample of intersections throughout Michigan. This direct observation study is being funded through a grant issued by this office.

This letter is to advise you that a University of Michigan employee will be carrying out the observations a various intersections within your jurisdiction. A schedule of the exact times and locations of the observation sites by time of day and day of week is enclosed. No interference with traffic flow is expected, since this is only an observation study. Motorists will not be stopped or interviewed.

The study will provide important information on the overall use of seat belts and child restraints by Michigan's motor vehicle occupants. Your cooperation is very much appreciated. If you have any questions, please feel free to contact this office at any time.

Sincerely,

Karen Gulliver

KAREN GULLIVER
Executive Director

Appendix F

OBSERVER TIME SCHEDULES

Observer Number 1: Karen Businski

Date	PSU	Time	Site/City(Township)
11/25	Travel Day		
11/26	Delta	11:15-12:00	005: Third Ave N. at N. Lincoln, Escanaba
		12:45- 1:30	006: Ludington at Stephenson, Escanaba
		2:30- 3:15	007: Ludington at Twelfth, Escanaba
		4:00- 4:45	008: Fifth Ave. S. at M-35(Lincoln), Escanaba
11/27	Dickinson	8:15- 9:00	009: US-2 at US-141, Breitung Twp.
		9:45-10:30	010: H St. at M-95(Carpenter), Iron Mountain
		11:15-12:00	011: East Blvd./Nelson at M-95(Carpenter), Kingsford
		1:00- 1:45	012: Hughitt at US-2(Stephenson), Iron Mountain
11/28	Marquette	9:45-10:30	013: US-41(Palms) at Second St., Ishpeming
		11:15-12:00	014: US-41(Maple) at Baldwin, Negaunee
		12:45- 1:30	015: W. Fair at Lincoln, Marquette
		2:30- 3:15	016: Magnetic at S. Seventh, Marquette
		4:00- 4:45	017: E. Hewitt at N. Third, Marquette
11/29	Marquette	8:30- 9:15	018: Washington at Lincoln, Marquette
		10:00-10:45	019: Washington at S. Front, Marquette
		11:30-12:15	020: M-28 at US-41, Chocolay Twp.
11/30	Chippewa	8:15- 9:00	001: Easterday at Ashmun, Sault Ste. Marie
		9:45-10:30	002: Easterday at Ryan, Sault Ste. Marie
		11:15-12:00	003: Portage at Ashmun, Sault Ste. Marie
		1:00- 1:45	004: I-75 Int'l Bridge Toll Booth, S.S. Marie
12/1	OFF		
12/2	Charlevoix	11:15-12:00	021: Water at Lake, Boyne City
		12:45- 1:30	022: Water at Park, Boyne City
		2:30- 3:15	023: Clinton at Bridge(NB), Charlevoix
		4:00- 4:45	024: Clinton at Bridge(SB), Charlevoix
12/3	Gd. Traverse	8:30- 9:15	029: US-31 at M-37, South of Traverse City
		10:00-10:45	030: US-31(Front) at Munson/Fair, Trv. City
		11:30-12:15	031: State at Union, Traverse City
		1:15- 2:00	032: Eighth at Boardman, Traverse City
12/4	Crawford/ Roscommon	11:00-11:45	025: M-18(Lake) at M-18(Fifth), Roscommon
		12:30- 1:15	026: M-55 & Old US-27, Lake Twp.(Houghton Lk)
		2:15- 3:00	027: Michigan at US-27 Bus., Grayling
		3:45- 4:30	028: M-72, M-93 at BL-75, M-72, Grayling

12/5	Iosco/ Alcona	11:00-11:45	036: M-72 at US-23, Harrisville
		12:30- 1:15	035: River Rd. at US-23(State), Oscoda
		2:15- 3:00	034: US-23 at Newman, East Tawas
		3:45- 4:30	033: M-55 at US-23, Tawas City
12/6	Bay	8:15- 9:00	101: N. Union at M-13(Euclid), Bay City
		9:45-10:30	102: Thomas(US-10) Exit at Euclid, Bay City
		11:15-12:00	103: Seventh at Washington, Bay City
		1:00- 1:45	104: Fremont at M-13(Broadway), Bay City
12/7	OFF		
12/8	Saginaw	9:30-10:15	110: Johnson at Washington, Saginaw
		11:00-11:45	111: M-58(Davenport) at N. Mason, Saginaw
		12:30- 1:15	112: Walnut at E. Genesee, Saginaw
		2:15- 3:00	114: Hess at Jefferson, Saginaw
		3:45- 4:30	115: Enterprise at M-84(Bay), Saginaw Twp.
12/9	Saginaw/ Genesee	8:15- 9:00	113: Ezra Rust Dr. at S. Washington, Saginaw
		9:45-10:30	116: I-475 NB Ramp at M-54(Saginaw), Gen. Co.
		11:15-12:00	109: I-75, US-23 NB Ramp at Pierson Rd. G.Co.
		1:00- 1:45	121: I-75, US-23 NB Ramp & Miller, Flint Twp.
		2:30- 3:15	122: Mount Morris at Genesee, Genesee Twp.
12/10	Genesee	9:30-10:15	123: Clark at M-15(State), Davison
		11:00-11:45	124: Pierson at Longfellow, Flint
		12:30- 1:15	125: I-69, M-21 EB Ramp at Dort Hwy., Flint
		2:15- 3:00	126: Court at Crapo, Flint
		3:45- 4:30	127: Flushing at Dupont, Flint
12/11	Genesee	8:15- 9:00	128: Third Ave. at Grand Traverse, Flint
		9:45-10:30	130: 12th St. at Van Dyke, Flint
		11:15-12:00	131: I-69, M-21 WB Ramp at Hammerberg, Flint
		1:00- 1:45	132: Second at Asylum, Flint
		2:30- 3:15	129: North at Leroy, Fenton
12/12	Lapeer	8:15- 9:00	105: M-21 EB Ramp & M-24(Lapeer), Lapeer Twp.
		9:45-10:30	106: East/Baldwin at M-24(Main), Lapeer
		11:15-12:00	107: M-21(Genesee) at Saginaw, Lapeer
		1:00- 1:45	108: Dryden Rd. at Mill Rd., Dryden

END

Observer Number 2: Ron Wakefield

Date	PSU	Time	Site/City(Township)
11/28	Jackson	11:00-11:45	089: SB US-127, I-94 & Boardman West, Blackman Twp.
		12:30- 1:15	090: Wildwood at N. Wisner, Jackson
		2:15- 3:00	091: Washington at S. Jackson, Jackson
		3:45- 4:30	092: Monroe/Chicago at M-50(Main), Brooklyn
11/29	Kalamazoo City	8:30- 9:15	097: Howard at Westnedge, Kalamazoo
		10:00-10:45	098: I-94 EB Ramp at Sprinkle, Kalamazoo
		11:30-12:15	099: W. South at Park, Kalamazoo
		1:15- 2:00	100: E. Michigan at King, Kalamazoo
		2:45- 3:00	095: I-94 WB Ramp at 9th, Oshtemo Twp.
11/30	Kalamazoo/ Van Buren	9:45-10:30	093: Parchmount at Riverview, Parchment
		11:15-12:00	094: Comstock at Sprinkle, Comstock Twp.
		12:45- 1:30	096: W. Michigan at 9th, Oshtemo Twp.
		2:30- 3:15	059: Michigan at Hazen, Paw Paw
		4:00- 4:45	060: M-51 at Phelps, Decatur
12/1	Berrien-Niles	9:45-10:30	045: Main at Second, Niles
		11:15-12:00	046: US-33 at Bell, Niles Twp.
		12:45- 1:30	047: US-31 NB Ramp at US-12, Niles
		2:30- 3:15	048: Bus. US-12(Main/Oak) at US-33(12th), Niles
		4:00- 4:45	043: Front at Redbud Trail, Buchanan
12/2	Berrien/ Van Buren	8:30- 9:15	041: US-12(Buffalo) at Whittaker, New Buffalo
		10:00-10:45	042: Glenlord at Bus. 94, Lincoln Twp
		11:30-12:15	044: I-94 EB Ramp at Pipestone, Benton Harbor
		1:15- 2:00	057: I-196 NB Ramp at Phoenix, South Haven
		2:45- 3:30	058: Blue Star Hwy. at M-140(Bus 196), South Haven
12/3	OFF		
12/4	Ottawa	11:15-12:00	053: Baldwin at 20th Ave., Georgetown Twp.
		12:45- 1:30	056: Eighth St. at Columbia Ave., Holland
		2:30- 3:15	054: Washington at Seventh St., Grand Haven
		4:00- 4:45	055: US-31 SB Freeway End at Jackson, Grand Haven
12/5	Muskegon	8:30- 9:15	049: Apple at Jefferson, Muskegon
		10:00-10:45	052: Spring at Bus US-31(Muskegon), Muskegon
		11:30-12:15	051: Airport at Grand Haven, Norton Shores
		1:15- 2:00	050: Laketon at NB US-31, Muskegon Twp.

12/6	Mason	11:15-12:00	037: US-10 at US-31, Pere Marquette Twp.
		12:45- 1:30	038: US-10(Ludington) at Harrison, Ludington
		2:30- 3:15	039: US-10(Ludington) at Rath, Ludington
		4:00- 4:45	040: US-10(State) at US-31(Main), Scottville
12/7	Mecosta	8:30- 9:15	073: M-20(Maple) & US-131(State), Big Rapids
		10:00-10:45	074: Baldwin/Pere Marquette at US-131(State), Big Rapids
		11:30-12:15	075: US-131, M-20(State) & Wood/Locust, Big Rapids
		1:15- 2:00	076: M-20 at M-66, Remus
12/8	Montcalm/ Kent	8:30- 9:15	077: M-46 at M-91, Cato Twp.
		10:00-10:45	078: Charles at M-91(Lafayette), Greenville
		11:30-12:15	079: M-57(Washington) & M-91(Lafayette), Greenville
		1:45- 2:30	061: US-131 NB Ramp & W. River, Plainfield Twp
		3:15- 4:00	080: I-96 WB Ramp at Plainfield, Grand Rapids
12/9	OFF		
12/10	Kent	9:45-10:30	063: M-21 at Ada Drive, Ada Twp.
		11:15-12:00	062: Lamoreaux at W. River, Plainfield Twp.
		12:45- 1:30	065: Plainfield at Knapp, Grand Rapids
		2:30- 3:15	067: Fountain at Division, Grand Rapids
		4:00- 4:45	068: SB US-131 Ramp at Wealthy, Grand Rapids
12/11	Kent	8:30- 9:15	066: Franklin at Madison, Grand Rapids
		10:00-10:45	064: 44th St. at Steelcase Dr., Grand Rapids
		11:30-12:15	070: 36th St. at Burlingame, Wyoming
		1:15- 2:00	072: 36th St. at Jefferson, Wyoming
		2:45- 3:30	071: 28th St. at Clyde Park, Wyoming
12/12	Kent/ Barry	9:45-10:30	081: SB US-131 Ramp at 44th St., Wyoming
		11:15-12:00	069: SB US-131 Ramp at 28th St., Wyoming
		12:45- 1:30	082: M-37(Broadway) at Main, Middleville
		2:30- 3:15	084: M-37(State) at Broadway, Hastings
		4:00- 4:45	083: Mill at Michigan, Hastings
12/13	Eaton/ Ingham	9:45-10:30	088: Lovett at Bostwick, Charlotte
		11:15-12:00	085: M-43(Saginaw) & M-100(Clinton), Grand Ledge
		12:45- 1:30	086: St. Joe Hwy. at Creyts, Delta Twp.
		2:30- 3:15	087: I-496 WB Ramp at Creyts, Delta Twp.
		4:00- 4:15	133: M-43(Saginaw) at Waverly, Lansing Twp.
12/14	Ingham	8:15- 9:00	134: Holt at Aurelius, Delhi Twp.
		9:45-10:30	135: I-96 EB & WB Ramps & Pennsylvania, Lansing
		11:15-12:00	139: I-496 N. Service Dr.(St. Joe) & Pennsylvania, Lans
		1:00- 1:45	140: Michigan at Grand River, E. Lansing
		2:30- 3:15	136: M-43(Grand River) at Putnam, Williamston

END

Observer Number 3: Meg Wiviott

Date	PSU	Time	Site/City(Township)
11/30	Washtenaw	9:30-10:15	185: S. University & Washtenaw, Ann Arbor
		11:00-11:45	186: Huron at Ashley, Ann Arbor
		12:30- 1:15	187: William at Fifth, Ann Arbor
		2:15- 3:00	188: EB I-94 Ramp at State, Ann Arbor
		3:45- 4:30	144: WB I-94 Ramp at State, Ann Arbor
12/1	Oakland	8:15- 9:00	161: Clarkston at Sashabaw, Independence Twp.
		9:45-10:30	162: Pontiac Lake Rd. at Airport, Waterford Twp.
		11:15-12:00	170: Square Lake Rd. at Woodward, Bloomfield Twp.
		1:00- 1:45	169: Quarton at Cranbrook, Bloomfield Twp.
		2:30- 3:15	165: Bowers at Adams, Birmingham
12/2	Oakland	9:30-10:15	164: Pontiac Trail at Milford, New Hudson
		11:00-11:45	163: I-96 EB Ramp at Novi, Novi
		12:30- 1:15	176: Grand River at Drake, Farmington Hills
		2:15- 3:00	173: I-696 WB & Orchard Lake, Farmington Hills
		3:45- 4:30	174: Nine Mile at Lahser, Southfield
12/3	Oakland	8:15- 9:00	171: M-59 EB at Opdyke, Pontiac
		9:45-10:30	172: Avon at Crooks, Avon Twp.
		11:15-12:00	167: Wattles at Crooks, Troy
		1:00- 1:45	183: Thirteen Mile at Crooks, Royal Oak
		2:30- 3:15	182: Twelve Mile at Crooks, Royal Oak
12/4	Oakland	8:15- 9:00	175: Telegraph SB Crossover at 9 Mile, Southfield
		9:45-10:30	181: Fourth at Troy, Royal Oak
		11:15-12:00	184: I-75 NB Ramp at 14 Mile, Troy
		1:00- 1:45	166: I-75 NB Ramp at Big Beaver, Troy
		2:30- 3:15	168: Big Beaver at John R, Troy
12/5	OFF		
12/6	Oakland	11:00-11:45	177: I-75 NB Ramp at 12 Mile, Madison Heights
		12:30- 1:15	178: 12 Mile at Campbell, Madison Heights
		2:15- 3:00	179: Meyers at John R, Hazel Park
		3:45- 4:30	180: Northend at Coolidge, Oak Park
12/7	Wayne-Livonia/Garden City	8:15- 9:00	225: Six Mile at Levan, Livonia
		9:45-10:30	226: Plymouth at Levan, Livonia
		11:15-12:00	227: I-96 WB Service Dr(Schoolcraft) at Newburgh, Liv
		1:00- 1:45	228: I-275 SB Ramp at Six Mile, Livonia
		2:30- 3:15	224: I-275 SB Ramp at Ann Arbor Rd., Plymouth Twp.

12/8	Wayne-Garden City	9:30-10:15	221: Marquette at Venoy, Garden City
		11:00-11:45	222: Warren at Venoy, Garden City
		12:30- 1:15	223: Block at Middlebelt, Garden City
		2:15- 3:00	217: Michigan at Canton Center, Canton Twp.
		3:45- 4:30	220: Joy at Canton Center, Canton Twp.
12/9	Wayne-Garden City/ Melvindale	9:30-10:15	219: M-153(Ford) at Sheldon Rd., Canton Twp.
		11:00-11:45	218: M-153(Ford) at I-275 SB Ramp, Canton Twp.
		12:30- 1:15	229: Oakwood at Allen, Melvindale
		2:15- 3:00	230: I-75 NB Ramp at M-39(Southfield), Lincoln Park
		3:45- 4:30	237: I-75 NB Ramp at Allen/Northline, Southgate
12/10	Macomb	8:15- 9:00	145: M-97(Groesbeck) at Kelly, Fraser
		9:45-10:30	146: I-94 EB Ramp at Little Mack, Roseville
		11:15-12:00	147: Eleven Mile at Bunert, Warren
		1:00- 1:45	148: Nine Mile at M-53(Van Dyke), Warren
12/11	OFF		
12/12	Macomb	11:00-11:45	149: M-53 NB Ramp at Hall, Sterling Heights
		12:30- 1:15	150: 24 Mile Rd. at Van Dyke, Shelby Twp.
		2:15- 3:00	151: M-59(Hall) at Delco Blvd., Sterling Heights
		3:45- 4:30	152: 15 Mile at Chrysler Dr., Sterling Heights
12/13	Macomb	8:15- 9:00	153: I-94 NB Ramp at Nine Mile, St. Clair Shores
		9:45-10:30	154: Masonic at Hoover, Warren
		11:15-12:00	155: 13 Mile/Chicago at General Motors Dr., Warren
		1:00- 1:45	156: Twelve Mile at Lorraine, Warren
12/14	Wayne	9:30-10:15	231: Oak/Whitehead/Haltiner & W. Jefferson, River Rouge
		11:00-11:45	232: Van Born at Hannan, Ecorse
		12:30- 1:15	238: Goddard at Jefferson, Wyandotte
		2:15- 3:00	239: Walnut at Jefferson, Wyandotte
		3:45- 4:30	240: Eureka at Fort, Wyandotte
12/15	Wayne	8:15- 9:00	235: Grosse Ile Pkwy. at Jefferson/River, Trenton
		9:45-10:30	233: Fort SB Crossover North of Williamsburg, Riverview
		11:15-12:00	234: Sibley at Quarry, Riverview
		1:00- 1:45	236: I-75 SB Ramp at West Rd., Woodhaven
		2:30- 3:15	160: EB I-94 Ramp at Belleville Rd., Van Buren Twp.
12/16	Wayne	8:15- 9:00	193: E. Seven Mile at Mound, Detroit
		9:45-10:30	194: I-75 NB Ramp at McNichols, Detroit
		11:15-12:00	195: E. 8 Mile WB Crossover & Fleming(east of Dequindre
		1:00- 1:45	196: E. Seven Mile at Van Dyke, Detroit
		2:30- 3:15	192: E. Seven Mile at Gratiot, Detroit

END

Observer Number 4: Charles Green

Date	PSU	Time	Site/City(Township)
11/26	Lenawee	1:30- 2:15	141: M-50(Chicago) at Evans in Tecumseh
		4:00- 4:45	143: Beecher at Center in Adrian
11/27	St. Clair	8:15- 9:00	117: M-21(Oak St. exit) & 24th St., Port Huron
		9:15-10:00	118: Hancock at M-25(Pine Grove) in Port Huron
		10:15-11:00	119: State at Stone in Port Huron
		12:00-12:45	120: Lapeer at 32nd St. in Port Huron Twp.
12/1	Monroe	8:15- 9:00	159: Sterns at Jackman in Bedford Twp.
		9:30-10:15	158: Stewart/Cole at M-125(Dixie) in Monroe
		10:45-11:30	157: Second at M-125(Monroe) in Monroe
12/2	Wayne-Detroit	9:30-10:15	213: US-10(Lodge) NB Ramp & Glendale in Detroit
		11:00-11:45	214: W. Eight Mile at Greenfield in Detroit
		12:30- 1:15	215: W. 8 Mile WB Crossover near Heyden, Detroit
		2:15- 3:00	216: 8 Mile & M-39(Southfield) SB Serv. Dr., Det.
		3:45- 4:30	198: Schoolcraft at St. Mary's in Detroit
12/4	Wayne-Detroit	8:15- 9:00	208: Seven Mile at Asbury Park in Detroit
		9:15-10:00	207: McNichols at Greenlawn in Detroit
		10:15-11:00	211: Joy at American in Detroit
12/8	Wayne-Detroit	8:15- 9:00	209: NEB I-75 Ramp at Dearborn in Detroit
		9:45-10:30	212: Michigan at Junction in Detroit
		11:15-12:00	205: I-94 EB Ramp & Grand Blvd. West in Detroit
		1:00- 1:45	204: 14th at W. Euclid in Detroit
		2:30- 3:15	210: W. Warren at Central in Detroit
12/9	Wayne-Detroit	9:15-10:00	197: I-96 EB Serv. Dr.(Schoolcraft & Burt, Detroit
		10:30-11:15	199: Lyndon at Schaefer in Detroit
		11:45-12:30	206: W. Outer Dr. at Wyoming in Detroit
		1:00- 1:30	201: W. Eight Mile at Woodward in Detroit
		2:00- 2:30	202: I-75 EB Ramp at Gratiot in Detroit
12/12	Wayne-Detroit	12:30- 1:15	189: E. Warren at Mack in Detroit
		3:00- 3:45	191: E. Outer Dr. at Gratiot in Detroit
		4:00- 4:45	190: I-94 WB Ramp at Gratiot in Detroit
12/13	Ingham	12:45- 1:30	138: Saginaw at Harrison in East Lansing
		2:15- 3:00	137: Lake Lansing at Hagadorn in East Lansing
12/15	Wayne-Detroit	12:15- 1:00	203: Rosa Parks at Ferry Park in Detroit
		3:00- 3:45	200: I-96 EB at Greenfield in Detroit

Appendix G

MICHIGAN DEPARTMENT OF TRANSPORTATION REGION MAP

DISTRICT and COUNTY NUMBERS