UMTRI-2003-05

An Evaluation of the "Click It Or Ticket"
Thanksgiving Mobilization Campaign

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February 2003

1. Report No. UMTRI-2003-05	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle An Evaluation of the "Click It Or Ticket" Thanksgiving Mobilization Campaign		5. Report Date February 2003
		6. Performing Organization Code
7. Author(s) David W. Eby, Jonathon M. Vivoda		8. Performing Organization Report No. UMTRI-2003-05
9. Performing Organization Name and Address The University of Michigan Transportation Research Institute 2901 Baxter Road Ann Arbor, MI 48109		10. Work Unit No. (TRAIS)
		11. Contract or Grant No. OP-02-01
12. Sponsoring Agency Name and Address Michigan Office of Highway Safety Planning 400 Collins Road, PO Box 30633 Lansing, MI 48909-8133		13. Type of Report and Period Covered Final 10/01/01 - 11/30/04
		14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

Two direct observation survey waves of safety belt use in Michigan were conducted around Thanksgiving of 2002. Between November 2 and 10, 2002, a baseline "mini" statewide survey wave was conducted on 5,130 motor vehicle occupants traveling in four vehicle types (passenger cars, sport-utility vehicles, vans/minivans, and pickup trucks). This mini survey consisted of a subsample of the annual full statewide survey of safety belt use in Michigan. Between December 2 and 16, 2002, a full statewide survey wave was conducted on 12,690 occupants during a media and enforcement campaign. A subsample of sites from the full survey were also extracted to match those observed during the mini survey. Belt use was estimated for all commercial/noncommercial vehicle types combined (the statewide safety belt use rate) for each survey wave, and for the extracted data. Statewide belt use was 80.9 percent during the mini survey, 80.5 percent for the full statewide survey, and 81.7 percent for the full survey extraction. These rates were not statistically different from one another. Safety belt use rates by stratum were also reported. Within each stratum, belt use did not significantly change between survey waves. Finally, belt use rates were calculated by seating position. Driver safety belt use was slightly higher than belt use by passengers for both the baseline and full survey, but about the same for the full survey extraction. Within each seating position, belt use did not change between the survey waves. Survey results suggest that the Thanksgiving mobilization did not significantly increase safety belt use in Michigan.

17. Key Words Motor vehicle occupant restraint use, safety belt use, child seat use, seat belt survey, direct observation survey, occupant protection, standard enforcement		18. Distribution Statement Unlimited	
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 50	22. Price

Reproduction of completed page authorized

CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACKNOWLEDGMENTS

INTRODUCTION

According to the American Travel Survey, the most traveled day of the year in the United States is the day after Thanksgiving (Bureau of Transportation Statistics, BTS, 1995). During the five days surrounding Thanksgiving, an average of 10.8 million trips per day are taken, representing nearly double the average daily amount of trips for the year. Of these trips, more than 83 percent are taken in a passenger vehicle (BTS, 1995). In 2000, about 500 people were killed in motor vehicle crashes during the Thanksgiving holiday (Centers for Disease Control and Prevention, CDC, 2001). Overall belt use in the United States during 2000 was estimated at 71 percent (National Highway Traffic Safety Administration, NHTSA, 2000a), but belt use for those occupants involved in fatal crashes was only 59 percent for passenger car occupants, and 55 percent for light truck occupants (NHTSA, 2000b). In Michigan, during the Thanksgiving holiday weekend of 2001, 12 people died as a result of motor vehicle crashes, of whom 30 percent were not using safety belts (Michigan Office of Highway Safety Planning, OHSP, 2002). By comparison, 17.7 percent of Michigan motorists overall did not use safety belts in 2001 (Eby & Vivoda, 2001).

This problem has been recognized at both the national and state level. For Thanksgiving, 2002, a major nationwide mobilization was announced by U.S. Transportation Secretary Norman Mineta (NHTSA, 2002). This mobilization involved media including the "Click It Or Ticket" and "Operation ABC" (America Always Buckles Up Children) campaigns, as well as increased high-visibility zero-tolerance police enforcement of the safety belt law, including checkpoints and saturation patrols (National Safety Council, NSC, 2002). Across the U.S., more than 12,000 law enforcement agencies monitored traffic and issued tickets. Teen drivers continued to be a focus of the mobilization, with many states enlisting the help of high school principals to announce the increased enforcement (NSC, 2002). Additionally, college and university police departments joined the mobilization efforts (NSC, 2002).

For Michigan's part in this mobilization, 18 counties received federal funding to increase police presence on the roads (OHSP, 2003a). These counties are the most populous in the state and represent the most problematic crash areas (OHSP, 2003a).

The mobilization in Michigan lasted about two weeks and included a media campaign as well as the involvement of 484 law enforcement agencies across the state. More than 19,000 safety belt citations were written during the mobilization (OHSP, 2003b).

To properly understand the effects of such a large effort to increase safety belt use, it is essential that the mobilization be evaluated. An evaluation can provide important information regarding different aspects of the program to assess which parts have been effective, and which parts might need to be changed in future campaigns. One part of any safety belt evaluation should include direct observation of the safety belt use rates. The purpose of the current study was to conduct two statewide direct observation surveys of safety belt use in Michigan. The first survey provided baseline safety belt use information before the mobilization began, while the second survey provided belt use information observed during and after the Thanksgiving mobilization.

METHODS

Sample Design

The current study consists of two survey waves, a "mini" statewide survey conducted as a baseline, and a full statewide survey conducted during and after an intervention. The sample design for the full statewide survey was closely based upon the one used by Streff, Eby, Molnar, Joksch, and Wallace (1993), while the mini survey consisted of a subsample of the full survey. The entire sampling procedure is presented here for completeness, with modifications noted. Procedures for selecting the subsample are detailed at the end of this section.

The goal of this sample design was to select observation sites that accurately represent front-outboard vehicle occupants in eligible commercial and noncommercial vehicles (i.e., passenger cars, vans/minivans, sport-utility vehicles, and pickup trucks) in Michigan, while following federal guidelines for safety belt survey design (NHTSA, 1992, 1998). An ideal sample minimizes total survey error while providing sites that can be surveyed efficiently and economically. To achieve this goal, the following sampling procedure was used.

To reduce the costs associated with direct observation of remote sites, NHTSA guidelines allow states to omit from their sample space the lowest population counties, provided these counties collectively account for 15 percent or less of the state's total population. Therefore, all 83 Michigan counties were rank ordered by population (U.S. Bureau of the Census, 1992) and the low population counties were eliminated from the sample space. This step reduced the sample space to 28 counties.

These 28 counties were then separated into four strata. The strata were constructed by obtaining historical belt use rates and vehicle miles of travel (VMT) for each county. Historical belt use rates were determined by averaging results from three previous University of Michigan Transportation Research Institute (UMTRI) surveys (Wagenaar & Molnar, 1989; Wagenaar, Molnar, & Businski, 1987b, 1988). Since no historical data were available for six of the counties, belt use rates for these counties were estimated using

3

multiple regression based on per capita income and education for the other 22 counties (r^2 = .56; U.S. Bureau of the Census, 1992).[1] These factors have been shown previously to correlate positively with belt use (e.g., Wagenaar, Molnar, & Businski, 1987a). Wayne County was chosen as a separate stratum because of its disproportionately high VMT, and because we wanted to ensure that observation sites were selected within this county. Three other strata were constructed by rank ordering each county by historical belt use rates and then adjusting the stratum boundaries until the total VMT was roughly equal within each stratum. The stratum boundaries were high belt use (greater than 54.0 percent), medium belt use (45.0 percent to 53.0 percent), low belt use (44.9 percent or lower), and Wayne County (41.9 percent belt use). The historical belt use rates and VMT by county and stratum are shown in Table 1.

To achieve the NHTSA required precision of less than 5 percent relative error, the minimum number of observation sites for the survey (N = 56) was determined based on within- and between-county variances from previous belt use surveys and on an estimated 50 vehicles per observation period in the current survey. This minimum number was then increased (N = 168) to get an adequate representation of belt use for each day of the week and for all daylight hours.

Because total VMT within each stratum was roughly equal, observation sites were evenly divided among the strata (42 each). In addition, since an estimated 23 percent of all traffic in Michigan occurs on limited-access roadways (Federal Highway Administration, 1982), 10 of the sites (24 percent) within each stratum were freeway exit ramps, while the remaining 32 were roadway intersections.

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[1] Education was defined as the proportion of population in the county over 25 years of age with a professional or graduate degree.

Table 1. Descriptive Characteristics of the Four Strata[2]					
Strata	County	Historical Belt Use, Percent	Belt Use Average, Percent	VMT, billions of miles	Total VMT, billions of miles
1			56.3		17.48
	Ingham	54.3		1.98	
	Kalamazoo	54.3		1.98	
	Oakland	54.5		10.66	
	Washtenaw	62.0		2.86	
2			48.8		17.42
	Allegan	*45.2*		0.86	
	Bay	53.7		1.13	
	Eaton	52.5		0.90	
	Gr. Traverse	47.2		0.63	
	Jackson	46.2		1.41	
	Kent	48.9		4.07	
	Livingston	*48.7*		1.44	
	Macomb	48.0		4.83	
	Midland	*50.7*		0.68	
	Ottawa	47.4		1.45	
3			40.9		17.15
	Berrien	41.6		1.68	
	Calhoun	*43.2*		1.40	
	Genesee	42.8		4.12	
	Lapeer	39.6		0.71	
	Lenawee	44.4		0.82	
	Marquette	39.6		0.56	
	Monroe	44.2		1.53	
	Muskegon	41.8		1.11	
	Saginaw	40.7		1.86	
	Shiawassee	*41.6*		0.64	
	St. Clair	34.1		1.38	
	St. Joseph	*41.6*		0.51	
	Van Buren	36.7		0.83	
4					
	Wayne	41.9	41.9	15.29	15.29

[2]Note: Boldface italic type indicates values estimated from multiple regression. The belt use percentages were used only for statistical purposes in this design. Caution should be taken when interpreting these values.

Within each stratum, observation sites were randomly assigned to a location using different methods for intersections and freeway exit ramps. The intersection sites were chosen using a method that ensured each intersection within a stratum an equal probability of selection. Detailed, equal-scale road maps for each county were obtained and a grid pattern was overlaid on each county map. The grid dimensions were 62 lines horizontally and 42 lines vertically. The lines of the grid were separated by 1/4 inch. With the *3/8 inch:mile* scale of the maps, this created grid squares that were .67 miles per side. (Because Marquette County is so large, it was divided into four maps and each part was treated as a separate county.) Each grid square was uniquely identified by two numbers, a horizontal (x) coordinate and a vertical (y) coordinate.

The 42 sites for each stratum were sampled sequentially. The 32 local intersection sites were chosen by first randomly selecting a grid number containing a county within a stratum.[3] This was achieved by generating a random number between 1 and the number of grids within the stratum. So, for example, since the high belt use stratum had four grid patterns overlaying four counties, a random number between 1 and 4 was generated to determine which grid would be selected. Thus, each grid had an equal probability of selection at this step. Once the grid was selected, a random x and a random y coordinate were chosen and the corresponding grid square identified. Thus, each intersection had an equal probability of selection. If a single intersection was contained within the square, that intersection was chosen as an observation site. If the square did not fall within the county, there was no intersection within the square, or there was an intersection but it was located one road link from an already selected intersection, then a new grid number and x, y coordinate were randomly selected. If more than one intersection was within the grid square, the grid square was subdivided into four equal sections and a random number between 1 and 4 was selected until one of the intersections was chosen. This happened for only two of the sites.

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[3] It is important to note that grids were selected during this step rather than counties. This was necessary only because it was impractical to construct a single grid that was large enough to cover all of the counties in the largest stratum when they were laid side by side.

Once a site was chosen, the following procedure was used to determine the particular street and direction of traffic flow that would be observed. For each intersection, all possible combinations of street and traffic flow were determined. From this set of observer locations, one location was randomly selected with a probability equal to 1/number of locations. For example, if the intersection, was a "+" intersection, as shown in Figure 1, there would then be four possible combinations of street and direction of traffic flow to be observed (observers watched traffic only on the side of the street on which they were standing). In Figure 1, observer location number one indicates that the observer would watch southbound traffic and stand next to Main Street. For observer location number two, the observer would watch eastbound traffic and stand next to Second Street, and so on. In this example, a random number between 1 and 4 would be selected to determine the observer location for this specific site. The probability of selecting an intersection approach is dependent upon the type of intersection. Four-legged intersections like that shown in Figure 1 have four possible observer locations, while three-legged intersections like "T" and "Y" intersections have only three possible observer locations. The effect of this slight difference in probability accounts for .01 percent or less of the standard error in the belt use estimate.
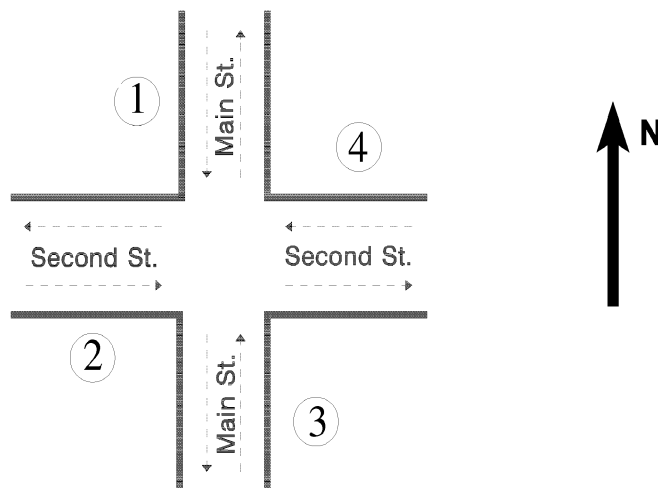
Figure 1. An Example "+" Intersection Showing 4 Possible Observer Locations.

For each primary intersection site, an alternate site was also selected. The alternate sites were chosen within a 20 x 20 square unit area around the grid square containing the original intersection, corresponding to a 13.4 square mile area around the site. This was achieved by randomly picking an *x, y* grid coordinate within the alternate site area. Grid coordinates were selected until a grid square containing an intersection was found. No grid squares were found that contained more than one intersection. The observer location at the alternate intersection was determined in the same way as at the primary site.[4]

The 10 freeway exit ramp sites within each stratum also were selected so that each exit ramp had an equal probability of selection.[5] This was done by enumerating all of the exit ramps within a stratum and randomly selecting without replacement 10 numbers between 1 and the number of exit ramps in the stratum. For example, in the high belt use stratum there were a total of 109 exit ramps. To select an exit ramp, a random number between 1 and 109 was generated. This number corresponded to a specific exit ramp. To select the next exit ramp, another random number between 1 and 109 was selected with the restriction that no previously selected numbers could be chosen. Once the exit ramps were determined, the observer location for the actual observation was determined by enumerating all possible combinations of direction of traffic flow and sides of the ramp on which to stand. As in the determination of the observer locations at the roadway intersections, the possibilities were then randomly sampled with equal probability. The alternate exit ramp sites were selected by taking the first interchange encountered after randomly selecting a direction of travel along the freeway from the primary site. If this alternate site was outside of the county or if it was already selected as a primary site, then the other direction of travel along the freeway was used. If the exit ramp had no traffic control device on the selected direction of travel, then a researcher visited the site and randomly picked a travel direction and lane that had such a device.

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[4] For those interested in designing a safety belt survey for their county or region, a guidebook and software for selecting and surveying sites for safety belt use is available (Eby, 2000) by contacting UMTRI -SBA, 2901 Baxter Rd., Ann Arbor, MI 48109-2150, or accessing http://www-personal.umich.edu/~eby/sbs.html/.

[5] An exit ramp is defined here as egress from a limited-access freeway, irrespective of the direction of travel. Thus, on a north-south freeway corridor, the north and south bound exit ramps at a particular cross street are considered a single exit ramp location.

The day of week and time of day for site observations were quasirandomly assigned to sites in such a way that all days of the week and all daylight hours (7:00 am - 7:00 pm) had essentially equal probability of selection. The sites were observed using a clustering procedure. That is, sites that were located spatially adjacent to each other were considered to be a cluster. Within each cluster, a shortest route between all of the sites was decided (essentially a loop) and each site was numbered. An observer watched traffic at all sites in the cluster during a single day. The day in which the cluster was to be observed was randomly determined. After taking into consideration the time required to finish all sites before dark, a random starting time for the day was selected. In addition, a random number between 1 and the number of sites in the cluster was selected. This number determined the site within the cluster where the first observation would take place. The observer then visited sites following the loop in either a clockwise or counterclockwise direction (whichever direction left them closest to UMTRI at the end of the day). This direction was determined by the project manager prior to sending the observer into the field. Because of various scheduling limitations (e.g., observer availability, number of hours worked per week) certain days and/or times were selected that could not be observed. When this occurred, a new day and/or time was randomly selected until a usable one was found. The important issue about the randomization is that the day and time assignments for observations at the sites were not correlated with belt use at a site. This quasirandom method is random with respect to this issue.

The sample design was constructed so that each observation site was self-weighted by VMT within each stratum. This was accomplished by selecting sites with equal probability and by setting the observation interval to a constant duration (50 minutes) for each site.[6] Thus, the number of vehicles observed at an observation site reflected safety belt use by VMT; that is, the higher the VMT at a site, the greater the number of vehicles that would pass during the 50-minute observation period. However, since all vehicles passing an observer could not be surveyed, a vehicle count of all eligible vehicles (i.e., passenger cars, vans/minivans, sport-utility vehicles, and pickup trucks) on the traffic leg

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[6] Because of safety considerations, sites in the city of Detroit were observed for a different duration. See data collection section for more information.

under observation was conducted for a set duration (5 minutes) immediately prior to and immediately following the observation period (10 minutes total).

Table 2 shows descriptive statistics for the 168 observation sites of the full statewide survey conducted in December, 2002. As shown in this table, the observations were fairly well distributed over day of week. Observations were also well distributed by time of day except for very early and late time periods. During December, daylight hours are generally limited to between 8 a.m. and 5 p.m. Note that an observation session was included in the time slot that represented the majority of the observation period. If the observation period was evenly distributed between two time slots, then it was included in the later time slot. This table also shows that every site observed was the primary site and that observations were mostly conducted during sunny and cloudy weather conditions, with a smaller percentage conducted during snow. No observations were conducted during rain.

Table 2. Descriptive Statistics for the 168 Observation Sites in the Full Statewide Survey							
Day of Week		**Observation Period**		**Site Choice**		**Weather**	
Monday	11.9%	7-9 a.m.	10.7%	Primary	100.0%	Sunny	54.2%
Tuesday	14.9%	9-11 a.m.	22.6%	Alternate	0.0%	Cloudy	39.9%
Wednesday	11.9%	11-1 p.m.	19.7%			Rain	0.0%
Thursday	19.0%	1-3 p.m.	23.2%			Snow	5.9%
Friday	16.7%	3-5 p.m.	23.8%				
Saturday	13.7%	5-7 p.m.	0.0%				
Sunday	11.9%						
TOTALS	100%		100%		100%		100%

Mini Survey Subsample Selection

The purpose of the mini survey was to determine the overall statewide safety belt use rate without the requirements of providing safety belt rates by day of week, time of day, or demographics of occupants. As described earlier, to achieve the required precision of less than 5 percent relative error, the minimum number of observation sites for the survey was determined to be 56 sites, 14 in each stratum. To begin the subsample selection, all

of the freeway sites within each stratum of the full statewide survey were assigned a number 1-10. Since 24 percent of the sites within each stratum of the full sample were freeway exit ramps (to match the freeway travel in Michigan), it was necessary for two of the subsample strata to have 3 freeway sites and the other two strata to have 4. To randomly determine which strata would have 3 freeway sites, two random numbers between 1 and 4 were generated to correspond with the stratum numbers. Random numbers corresponding to the freeway sites were then generated until the proper number had been chosen for each stratum. The remaining intersection sites within each stratum were assigned a number 1-32, and then a random number was generated between 1 and 32 for Stratum 1. The site that corresponded to that number was chosen as a site for the subsample. Random numbers continued to be generated without replacement until all 14 sites had been chosen within the stratum. This site selection process was repeated for each of the remaining 3 strata until all 56 sites had been sampled from the original 168. The scheduling of the sites for the mini survey was completed using the same clustering procedure described above.

Table 3 shows descriptive statistics for the 56 observation sites of the mini statewide survey conducted in November, 2002. As stated earlier, the purpose of this study was to provide only an overall estimate of statewide safety belt use in Michigan. Given the compressed schedule that was necessary to complete this survey, and the small number of sites relative to the full statewide survey, an even distribution of observations over day of week and time of day was not possible. As such, observations were not well distributed over day of week or time of day (see Table 3). Note that an observation session was included in the time slot that represented the majority of the observation period. If the observation period was evenly distributed between two time slots, then it was included in the later time slot. This table also shows that nearly every site observed was the primary site and that observations were mostly conducted during sunny and cloudy weather conditions, with a smaller percentage conducted during rainy weather. No observations were conducted during snow.

Table 3. Descriptive Statistics for the 56 Observation Sites in the Mini Statewide Survey							
Day of Week		**Observation Period**		**Site Choice**		**Weather**	
Monday	12.5%	7-9 a.m.	12.5%	Primary	98.2%	Sunny	37.5%
Tuesday	7.1%	9-11 a.m.	30.4%	Alternate	1.8%	Cloudy	48.2%
Wednesday	7.2%	11-1 p.m.	23.2%			Rain	14.3%
Thursday	12.5%	1-3 p.m.	19.6%			Snow	0.0%
Friday	14.3%	3-5 p.m.	14.3%				
Saturday	14.3%	5-7 p.m.	0.0%				
Sunday	32.1%						
TOTALS	100%		100%		100%		100%

Data Collection

Data collection for the study involved direct observation of shoulder belt use, estimated age, and sex. Trained field staff observed shoulder belt use of drivers and front-right passengers traveling in passenger cars, sport-utility vehicles, vans/minivans, and pickup trucks during daylight hours from November 2 through 10, 2002 for the mini statewide survey, and from December 2 through 16, 2002 for the full statewide survey. Observations of safety belt use, sex, age, vehicle type, and vehicle purpose (commercial or noncommercial) were conducted when a vehicle came to a stop at a traffic light or a stop sign.

Data Collection Forms

Two forms were used for data collection: a site description form and an observation form. The site description form (see Appendix A) provided descriptive information about the site including the site number, location, site type (freeway exit ramp or intersection), site choice (primary or alternate), observer number, date, day of week, time of day, weather, and a count of eligible vehicles traveling on the proper traffic leg. A place on the form was also furnished for observers to sketch the intersection and to identify observation locations and traffic flow patterns. Finally, a comments section was available for observers to identify landmarks that might be helpful in characterizing the site (e.g., school, shopping mall) and to discuss problems or issues relevant to the site or study.

A second form, the observation form, was used to record safety belt use, passenger information, and vehicle information (see Appendix A). Each observation form was divided into four boxes, with each box having room for the survey of a single vehicle. For each vehicle surveyed, shoulder belt use, sex, and estimated age of the driver as well as vehicle type were recorded on the upper half of the box, while the same information for the front-outboard passenger could be recorded in the lower half of the box if there was a front-outboard passenger present. Children riding in child safety seats (CSSs) were recorded but not included in any part of the analysis. Occupants observed with their shoulder belt worn under the arm or behind the back were noted but considered as belted in the analysis. Based upon NHTSA (1999) guidelines, the observer also recorded whether the vehicle was commercial or noncommercial. A commercial vehicle is defined as a vehicle that is used for business purposes and may or may not contain company logos. This classification includes vehicles marked with commercial lettering or logos, or vehicles with ladders or other tools on them. At each site, the observer carried several data collection forms and completed as many as were necessary during the observation period.

Procedures at Each Site

All sites in the sample were visited by one observer for a period of 1 hour, with the exception of sites in the city of Detroit. To address potential security concerns, these sites were visited by two-person observer teams for a period of 30 minutes. Observations at other Wayne County sites scheduled to be observed on the same day as Detroit sites were also completed by two observers. Because each team member at these sites recorded data for different lanes of traffic, the total amount of data collection time was equivalent to that at single observer sites.

Upon arriving at a site, observers determined whether observations were possible at the site. If observations were not possible (e.g., due to construction), observers proceeded to the alternate site. Otherwise, observers completed the site description form and then moved to their observation position near the traffic control device.

Observers were instructed to observe only the lane immediately adjacent to the curb for safety belt use, regardless of the number of lanes present. At sites visited by two-

13

person teams, team members observed different lanes of the same traffic leg with one observer on the curb and one observer on the median (if there was more than one traffic lane and a median). If no median was present, observers were instructed to stand on diagonally opposite corners of the intersection.

At each site, observers conducted a 5-minute count of all eligible vehicles in the designated traffic leg before beginning safety belt observations. Observations began immediately after completion of the count and continued for 50 minutes at sites with one observer and 25 minutes at sites with two observers. During the observation period, observers recorded data for as many eligible vehicles as they could observe. If traffic flow was heavy, observers were instructed to record data for the first eligible vehicle they saw, and then look up and record data for the next eligible vehicle they saw, continuing this process for the remainder of the observation period. At the end of the observation period, a second 5-minute vehicle count was conducted at one-observer sites.

Observer Training

Prior to data collection, field observers participated in five days of intensive training for the full survey, and two days of intensive training for the mini survey, including both classroom review of data collection procedures and practice field observations. Each observer received a training manual containing detailed information on field procedures for observations, data collection forms, and administrative policies and procedures. A site schedule identifying the location, date, time, and traffic leg to be observed for each site was included in the manual (see Appendix B for a listing of the sites).

After intensive review of the manual, observers conducted practice observations at several sites chosen to represent the types of sites and situations that would actually be encountered in the field. None of the locations of the practice sites were the same as sites observed during the study. Training at each practice site focused on completing the site description form, determining where to stand and which lanes to observe, conducting the vehicle count, recording safety belt use, and estimating age and sex. Observers worked in teams of two, observing the same vehicles, but recording data independently on separate data collection forms. The forms were then compared for accuracy. Teams were

rotated throughout the training to ensure that each observer was paired with every other observer. Each observer pair practiced recording safety belt use, sex, and age until there was an interobserver reliability of at least 85 percent for all measures on drivers and front-right passengers for each pair of observers.

Each observer was provided with an atlas of Michigan county maps and all necessary field supplies. Observers were given time to locate their assigned sites on the appropriate maps and plan travel routes to the sites. After marking the sites on their maps, the marked locations were compared to a master map of locations to ensure that the correct sites had been pinpointed. Field procedures were reviewed for the final time and observers were informed that unannounced site visits would be made by the field supervisor during data collection to ensure adherence to study protocols.

Observer Supervision and Monitoring

During data collection, each observer was spot checked in the field on at least two occasions by the field supervisor. Contact between the field supervisor and field staff was also maintained on a regular basis through staff visits to the UMTRI office to deliver completed forms and through telephone calls from staff to report progress and discuss problems encountered in the field. Field staff were instructed to call the field supervisor's home or cellular phone if problems arose during evening hours or on weekends.

Incoming data forms were examined by the field supervisor and problems (e.g., missing data, discrepancies between the site description form and site listing or schedule) were noted and discussed with field staff. Attention was also given to comments on the site description form about site-specific characteristics that might affect future surveys (e.g., traffic flow patterns, traffic control devices, site access).

Data Processing and Estimation Procedures

The site description form and observation form data were entered into an electronic format. The accuracy of the data entry was verified in two ways. First, all data were entered twice and the data sets were compared for consistency. Second, the data from randomly selected sites were reviewed for accuracy by a second party and all site data

were checked for inconsistent codes (e.g., the observation end time occurring before the start time). Errors were corrected after consultation with the original data forms.

For each site, a computer analysis program determined the number of observed vehicles, belted and unbelted drivers, and belted and unbelted passengers. Separate counts were made for each independent variable in the survey (i.e., site type, time of day, day of week, weather, sex, age, seating position, and vehicle type). This information was combined with the site information to create a file used for generating study results.

As mentioned earlier, our goal in this safety belt survey was to estimate belt use for the state of Michigan based on VMT. As also discussed, the self-weighting-by-VMT scheme employed is limited by the number of vehicles for which an observer can accurately record information. To correct for this limitation, the vehicle count information was used to weight the observed traffic volumes so they would more accurately reflect VMT.

This weighting was done by first adding each of the two 5-minute counts and then multiplying this number by five so that it would represent a 50-minute duration.[7] The resulting number was the estimated number of vehicles passing through the site if all eligible vehicles had been included in the survey during the observation period at that site. The estimated count for each site is divided by the actual number of vehicles observed there to obtain a volume weighting factor for that site. These weights are then applied to the number of actual vehicles of each type observed at each site to yield the weighted N for the total number of drivers and passengers, and total number of belted drivers and passengers for each vehicle type. Unless otherwise indicated, all analyses reported are based upon the weighted values.

The overall estimate of belt use per VMT in Michigan was determined by first calculating the belt use rate within each stratum for observed vehicle occupants in all vehicle types using the following formula:

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[7] As mentioned previously, the Detroit sites were visited by pairs of observers for half as long. For these sites, the single 5-minute count was multiplied by five to represent the 25-minute observation period.

$$r_i' \frac{Total\ Number\ of\ Belted\ Occupants,\ weighted}{Total\ Number\ of\ Occupants,\ weighted}$$

where r_i refers to the belt use rate within any of the four strata. The totals are the sums across all 42 sites within the stratum after weighting, and occupants refers to only front-outboard occupants. The overall estimate of belt use was computed by averaging the belt use rates for each stratum. However, comparing total VMT among the strata, one finds that the Wayne County stratum is only 88 percent as large as the total VMT for the other three strata (see Table 1). In order to represent accurately safety belt use for Michigan by VMT, the Wayne County stratum was multiplied by 0.88 during the averaging to correct for its lower total VMT. The overall belt use rate was determined by the following formula:

$$r_{all}' \frac{r_1 \% r_2 \% r_3 \% 0.88(r_4)}{3.88}$$

where r_i is the belt use rate for a certain vehicle type within each stratum and r_4 the Wayne County stratum.

The estimates of variance and the calculation of the confidence bands for the belt use estimates are complex. See Appendix C for a detailed description of the formulas and procedures. The same use rate and variance equations were utilized for the calculation of use rates for each vehicle type separately.

17

RESULTS

As discussed previously, the current study of safety belt use in Michigan reports results from two direct observation survey waves. The first survey wave consisted of a mini statewide survey, or subsample of the full survey, and was conducted between November 2 and 10, 2002. The second survey wave was a full statewide survey conducted between December 2 and 16, 2002. Additional analyses were conducted on the full survey data to extract the sites that match the mini survey sites, to allow for a direct comparison between the two survey waves. However, it should be noted that due to scheduling differences, these sites were observed at different times of the day and days of the week. All comparisons below will contain these three sets of data, the November mini survey (baseline), the December full survey (media & enforcement - full), and the December extraction (media & enforcement - extraction). Due to the relatively small number of observations in the mini survey, only overall safety belt use rates, belt use rates by stratum, and belt use rates by seating position are available. Only these data are included for comparison in this report.

Overall Safety Belt Use

As shown in Table 4, 80.9 ± 2.5 percent of all front-outboard occupants were restrained with shoulder belts during the baseline period. The "±" value following the use rate indicates a 95 percent confidence band around the percentage. This value should be interpreted to mean that we are 95 percent sure that the actual safety belt use rate falls somewhere between 78.4 percent and 83.4 percent. During the media & enforcement period, the overall belt use rate was 80.5 ± 2.0 percent. The extraction from the media & enforcement period shows a belt use rate of 81.7 ± 2.7 percent. The analysis reveals that these three rates are statistically the same.

Table 4: Overall Safety Belt Use and Unweighted N's by Survey Wave			
	November - Mini (Baseline)	December - Full (Media & Enforcement)	December - Mini Extraction (Media & Enforcement)
Statewide Rate (N)	80.9 ± 2.5 (5,130)	80.5 ± 2.0 (12,690)	81.7 ± 2.7 (4,133)

Safety Belt Use by Stratum

Estimated safety belt use by stratum and survey wave is shown in Table 5. This table shows that within each stratum, belt use did not significantly change across the survey waves. Similarly, within each survey wave, belt use is not significantly different between strata, with the exception of the baseline survey conducted in November, 2002. In this survey, the safety belt use observed in Stratum 3 is significantly lower than Strata 1 and 2. There is no obvious explanation for this finding; historically, belt use in Michigan has been lower in Stratum 4 than the other strata (Eby, Molnar, & Olk, 2000), although these differences have diminished somewhat in recent surveys (Eby, Vivoda, & Fordyce, 2002)

Table 5: Safety Belt Use and Unweighted N's by Stratum and Survey Wave			
	November - Mini (Baseline)	December - Full (Media & Enforcement)	December - Mini Extraction (Media & Enforcement)
Stratum 1	83.6 ± 2.3 (1,567)	82.4 ± 6.0 (3,526)	84.6 ± 5.1 (1,278)
Stratum 2	87.3 ± 5.4 (827)	81.2 ± 2.7 (2,689)	79.4 ± 6.2 (806)
Stratum 3	74.7 ± 6.4 (582)	79.7 ± 3.2 (1,958)	82.1 ± 5.5 (534)
Stratum 4	77.8 ± 5.4 (2,154)	78.4 ± 3.3 (4,517)	80.4 ± 4.3 (1,515)

Safety Belt Use by Seating Position

Estimated safety belt use by position in vehicle and survey wave is shown in Table 6. This table shows that safety belt use for drivers is slightly higher than use by front-right passengers for both the baseline (November - Mini) and media & enforcement - full (December - Full) waves. Belt use for drivers and passengers in the extraction of the media & enforcement wave was essentially the same. Safety belt use remained the same across survey waves for both drivers and passengers.

Table 6: Safety Belt Use and Unweighted N's by Seating Position and Survey Wave			
	November - Mini (Baseline)	December - Full (Media & Enforcement)	December - Mini Extraction (Media & Enforcement)
Driver	81.4 (4,004)	80.6 (10,277)	81.6 (3,291)
Passenger	79.3 (1,126)	78.9 (2,413)	81.8 (842)

DISCUSSION

The estimated statewide safety belt use rates for front-outboard occupants of passenger cars, sport-utility vehicles, vans/minivans, and pickup trucks combined was 80.9 ± 2.5 percent during the baseline (November - Mini) survey wave, 80.5 ± 2.0 during the media & enforcement - full (December - Full) wave, and 81.7 ± 2.7 for the extraction from the media and enforcement (December - Mini Extraction) wave. The differences between these rates are not statistically significant.

Belt use rates were also analyzed as a function of stratum and survey wave. In the baseline survey, motorists in Stratum 3 had significantly lower use rates than those in Strata 1 and 2. No other statistically significant differences were observed within the baseline survey wave, or in either the full or extracted datasets from the media & enforcement survey wave. Additionally, there were no statistically significant differences between survey waves within each stratum. In other words, both overall, and within any given stratum, safety belt use did not significantly change from November to December, 2002.

The study also examined safety belt use by position in vehicle and survey wave. Belt use remained the same across survey waves within each of the two seating positions observed. For both the baseline and media & enforcement - full survey waves, driver belt use was slightly higher than passenger belt use, but belt use for drivers and passengers in the extracted data from the media & enforcement survey wave was essentially the same. Traditionally, belt use has been consistently higher for the driver than the passenger in Michigan (see e.g., Eby, Molnar, & Olk, 2000, Eby, Vivoda, & Fordyce, 2002), so there is no obvious explanation for this result.

These findings suggest that the Thanksgiving mobilization conducted in Michigan did not result in a statewide increase in safety belt use. There are several critical factors that must be present in any safety belt intervention program in order for it to be successful. NHTSA (2001) research suggests that there must be an aggressive program including both media and increased police enforcement to have an effect. Given this, it may be the case that in Michigan, one of these factors was not successful in reaching the intended

audience. For example, it may be true that the media message about increased police enforcement did reach the motoring public, but the public did not see additional officers on the road, and therefore did not perceive an increase in the likelihood of receiving a citation. On the other hand, the media may not have been effective in giving motorists the perception that police would be increasing their presence on the roads during this time. If this was the case, the increased enforcement would only affect those motorists who happened to be in the target areas. To assess the effectiveness of the media message and perceived enforcement presence, a telephone survey was conducted by EPIC-MRA. An analysis of these data may prove helpful in understanding if there was a problem with one of the factors of the mobilization efforts.

Another explanation for these results may be that the Thanksgiving mobilization affected different groups of motorists in different ways. As stated before, the reduced number of sites in the mini survey only allows for an analysis of the overall safety belt use rate for the state, and the belt use rates by seating position and stratum. Further analyses would not be meaningful due to low sample sizes. Consequently, it was not possible for this survey to capture differences in belt use by age, sex, or vehicle type. It may be that the mobilization positively affected belt use in some of the traditionally low belt use groups (toward which the program was targeted), but there was an overall decrease in belt use within the other groups. These types of changes would not be captured in a survey designed to report only an overall use rate.

Finally, there has been some evidence that belt use tends to decrease in the cold winter months (Eby, Vivoda, & Fordyce, 2000). If belt use normally decreases as it gets cold outside, but the rates remained the same from November through December, this stabilization may be due to the Thanksgiving mobilization. The campaign to increase belt use may have been effective in maintaining the rate, when a decline would have otherwise occurred.

Programs that promote safety belt use should continue to be implemented in Michigan. The most recent statewide belt use rate of 80.5 percent still reflects a traffic safety problem of nearly 20 percent of the motoring public continuing to ride unbelted. It is especially important for evaluations of these programs in Michigan, and across the country, to continue. For a state like Michigan, where standard enforcement has been

implemented and many other efforts to increase safety belt use continue, it is important that we understand which programs are effective and which ones are not. This information will allow the traffic safety community to properly address the issue and more effectively focus efforts and money on the 20 percent that remain unbuckled in Michigan.

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APPENDIX A

Data Collection Forms

SITE # __ __ __   SITE LOCATION_____
         1 2 3

SITE TYPE   SITE CHOICE   TRAFFIC CONTROL

1   Intersection   1   Primary   1   Traffic Light

2   Freeway   2   Alternate   2   Stop sign

     4   5   3   None

Exit No. _____   4   Other _____
                                               6

DATE (month/day): __ __/__ __/2002
                   7 8   9 10

OBSERVER   DAY OF WEEK   WEATHER

1   Steve   1   Monday   1   Mostly Sunny

2   Mark   2   Tuesday   2   Mostly Cloudy

3   Jonathon   3   Wednesday   3   Rain

4   Dave   4   Thursday   4   Snow
     11   13
                    5   Friday

                    6   Saturday

                    7   Sunday
                        12

START TIME: __ __:__ __ (24 hour clock)   END TIME: __ __:__ __ (24 hour clock)
            14 15 16 17   18 19 20 21

INTERRUPTION (total number of minutes during observation period): __ __
                                                                   22 23

MEDIAN: 1   Yes
             2   No
                 24

TRAFFIC COUNT 1: __ __ __
                 25 26 27

TRAFFIC COUNT 2:__ __ __
                28 29 30
COMMENTS:

North

31

SITE # __ __ __   SITE LOCATION_____
      1 2 3

SITE TYPE	SITE CHOICE	TRAFFIC CONTROL
1 Intersection	1 Primary	1 Traffic Light
2 Freeway	2 Alternate	2 Stop sign
4	5	3 None
Exit No. _____		4 Other _____
		6

DATE (month/day): __ __/__ __/2002
                  7 8 9 10

OBSERVER	DAY OF WEEK	WEATHER
1 Dave J.	1 Monday	1 Mostly Sunny
2 Dave S.	2 Tuesday	2 Mostly Cloudy
3 Mark	3 Wednesday	3 Rain
4 Steve	4 Thursday	4 Snow
5 Jonathon	5 Friday	13
6 Dave E.	6 Saturday	
11	7 Sunday	
	12	

START TIME: __ __:__ __ (24 hour clock)   END TIME: __ __:__ __ (24 hour clock)
           14 15 16 17   18 19 20 21

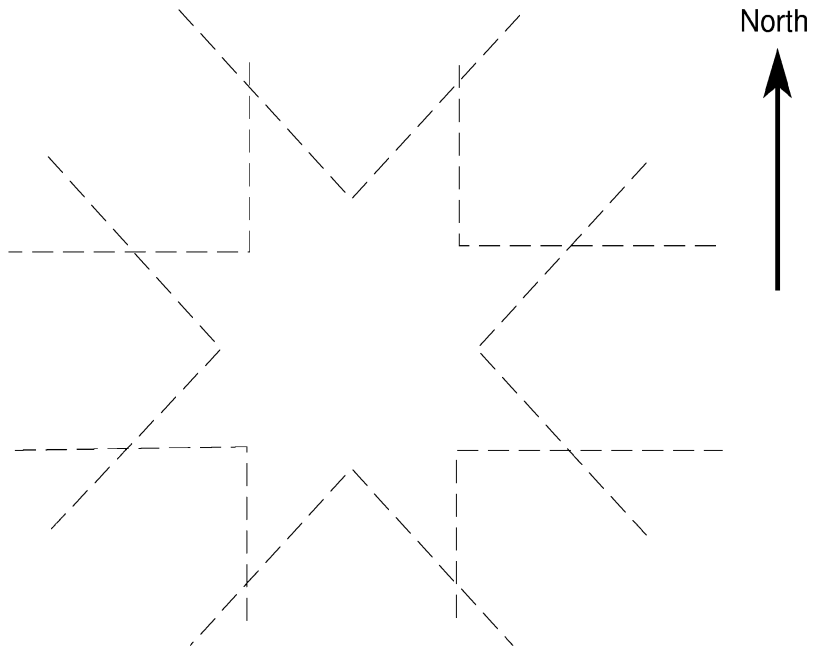INTERRUPTION (total number of minutes during observation period): __ __
                                                           22 23

MEDIAN: 1   Yes
            2   No
              24

North

TRAFFIC COUNT 1: __ __ __
                      25 26 27

TRAFFIC COUNT 2: __ __ __
                      28 29 30

COMMENTS:

ATTENTION CODING: DUPLICATE COL 1 - 3 FOR ALL VEHICLES

DRIVER	1 Not belted
	2 Belted
	3 B Back
	4 U Arm
	   4
		1 Male
		2 Female
		   5
			2 4 - 15
			3 16 - 29
			4 30 - 59
			5 60+
			   6
				VEHICLE TYPE
				1 Passenger car
				2 Van
				3 Utility
				4 Pick-up
				  7	

FRONT-RIGHT PASSENGER	1 Not belted
	2 Belted
	3 B Back
	4 U Arm
	5 CRD
	   8
		1 Male
		2 Female
		   9
			1 0 - 3
			2 4 - 15
			3 16 - 29
			4 30 - 59
			5 60+
			   10
				Office Use Only:
				
				___ ___ ___
				11 12 13
					COMM. VEHICLE
					
					1 No
					2 Yes
					  14

DRIVER	1 Not belted
	2 Belted
	3 B Back
	4 U Arm
	   4
		1 Male
		2 Female
		   5
			2 4 - 15
			3 16 - 29
			4 30 - 59
			5 60+
			   6
				VEHICLE TYPE
				1 Passenger car
				2 Van
				3 Utility
				4 Pick-up
				  7	

FRONT-RIGHT PASSENGER	1 Not belted
	2 Belted
	3 B Back
	4 U Arm
	5 CRD
	   8
		1 Male
		2 Female
		   9
			1 0 - 3
			2 4 - 15
			3 16 - 29
			4 30 - 59
			5 60+
			   10
				Office Use Only:
				
				___ ___ ___
				11 12 13
					COMM. VEHICLE
					
					1 No
					2 Yes
					  14

DRIVER	1 Not belted
	2 Belted
	3 B Back
	4 U Arm
	   4
		1 Male
		2 Female
		   5
			2 4 - 15
			3 16 - 29
			4 30 - 59
			5 60+
			   6
				VEHICLE TYPE
				1 Passenger car
				2 Van
				3 Utility
				4 Pick-up
				  7	

FRONT-RIGHT PASSENGER	1 Not belted
	2 Belted
	3 B Back
	4 U Arm
	5 CRD
	   8
		1 Male
		2 Female
		   9
			1 0 - 3
			2 4 - 15
			3 16 - 29
			4 30 - 59
			5 60+
			   10
				Office Use Only:
				
				___ ___ ___
				11 12 13
					COMM. VEHICLE
					
					1 No
					2 Yes
					  14

DRIVER	1 Not belted
	2 Belted
	3 B Back
	4 U Arm
	   4
		1 Male
		2 Female
		   5
			2 4 - 15
			3 16 - 29
			4 30 - 59
			5 60+
			   6
				VEHICLE TYPE
				1 Passenger car
				2 Van
				3 Utility
				4 Pick-up
				  7	

FRONT-RIGHT PASSENGER	1 Not belted
	2 Belted
	3 B Back
	4 U Arm
	5 CRD
	   8
		1 Male
		2 Female
		   9
			1 0 - 3
			2 4 - 15
			3 16 - 29
			4 30 - 59
			5 60+
			   10
				Office Use Only:
				
				___ ___ ___
				11 12 13
					COMM. VEHICLE
					
					1 No
					2 Yes
					  14

APPENDIX B

Site Listing

No.	County	Site Location	Type	Str
001	Oakland	EB Whipple Lake Rd. & Eston Rd.	I	1
*002	Kalamazoo	EB S Ave. & 29th St.	I	1
003	Oakland	SB Pontiac Trail & 10 Mile Rd.	I	1
004	Washtenaw	SB Moon Rd. & Ann Arbor-Saline Rd./Saline-Milan Rd.	I	1
005	Oakland	WB Drahner Rd. & Baldwin Rd.	I	1
006	Oakland	SB Rochester Rd. & 32 Mile Rd./Romeo Rd.	I	1
007	Oakland	SB Williams Lake Rd. & Elizabeth Lake Rd.	I	1
008	Ingham	SB Searles Rd. & Iosco Rd.	I	1
*009	Kalamazoo	WB D Ave. & Riverview Dr.	I	1
010	Washtenaw	EB N. Territorial Rd. & Dexter-Pinckney Rd.	I	1
*011	Washtenaw	NB Schleeweis Rd./Macomb St. & W. Main St.	I	1
012	Ingham	NB Shaftsburg Rd. & Haslett Rd.	I	1
013	Oakland	NB Middlebelt Rd. & 9 Mile Rd.	I	1
*014	Washtenaw	WB Packard Rd. & Carpenter Rd.	I	1
015	Ingham	EB Haslett Rd. & Marsh Rd.	I	1
*016	Washtenaw	NB Jordan Rd./Monroe St. & US-12/Michigan Ave.	I	1
017	Washtenaw	SB M-52/Main St. & Old US-12	I	1
018	Kalamazoo	SB 8th St. & Q Ave.	I	1
*019	Washtenaw	WB 8 Mile Rd. & Pontiac Trail	I	1
*020	Oakland	SB Lahser Rd. & 11 Mile Rd.	I	1
*021	Kalamazoo	NB Ravine Rd. & D Ave.	I	1
022	Washtenaw	EB Glacier Way/Glazier Way & Huron Pkwy.	I	1
023	Washtenaw	WB Bethel Church Rd. & M-52	I	1
024	Washtenaw	SB Platt Rd. & Willis Rd.	I	1
*025	Ingham	WB Fitchburg Rd. & Williamston Rd.	I	1
026	Washtenaw	EB Merritt Rd. & Stoney Creek Rd.	I	1
027	Oakland	SB Hickory Ridge Rd. & M-59/Highland Rd.	I	1
028	Kalamazoo	SB Douglas Ave. & D Ave.	I	1
*029	Oakland	WB Walnut Lake Rd. & Haggerty Rd.	I	1
030	Oakland	NB Jossman Rd. & Grange Hall Rd.	I	1
031	Kalamazoo	EB H Ave. & 3rd St.	I	1
032	Kalamazoo	EB TU Ave. & 24th St./Sprinkle Rd.	I	1
033	Oakland	WBD I-96 & Milford Rd.. (Exit 155B)	ER	1
*034	Washtenaw	WBP I-94 & Whittaker Rd./Huron St. (Exit 183)	ER	1
*035	Kalamazoo	SBP US-131 & M-43 (Exit 38B)	ER	1
036	Washtenaw	SBD US-23 & N. Territorial Rd.	ER	1
*037	Kalamazoo	EBP I-94 & Portage Rd.	ER	1
038	Oakland	EBP I-696 & Orchard Lake Rd. (Exit 5)	ER	1
039	Kalamazoo	WBP I-94 & 9th St. (Exit 72)	ER	1
*040	Washtenaw	WBD I-94 & Jackson Rd.	ER	1
041	Kalamazoo	NBD US-131 & Stadium Dr./Business I-94	ER	1
042	Kalamazoo	NBP US-131 & Q Ave./Centre Ave.	ER	1
*043	Livingston	SB County Farm Rd. & Coon Lake Rd.	I	2
044	Bay	WB Nebodish Rd. & Knight Rd.	I	2

045	Macomb	SB Camp Ground Rd. & 31 Mile Rd.	I	2
046	Jackson	SB Benton Rd./Moon Lake Rd. & M-50/ Brooklyn Rd.	I	2
047	Allegan	SB 6th St. & M-89	I	2
048	Kent	EB 36th St. & Snow Ave.	I	2
049	Livingston	EB Chase Lake Rd. & Fowlerville Rd.	I	2
*050	Allegan	WB 144th Ave. & 2nd St.	I	2
051	Livingston	SB Cedar Lake Rd. & Coon Lake Rd.	I	2
052	Jackson	NB Mt. Hope Rd. & Waterloo-Munith Rd.	I	2
*053	Kent	WB Cascade Rd. & Thornapple River Dr.	I	2
*054	Allegan	NB 62nd St. & 102nd Ave.	I	2
055	Kent	SB Meddler Ave. & 18 Mile Rd.	I	2
056	Eaton	SB Houston Rd. & Kinneville Rd.	I	2
057	Macomb	SB M-19/Memphis Ridge Rd. & 32 Mile Rd./ Division Rd.	I	2
*058	Allegan	NB 66th St. & 118th Ave.	I	2
059	Grn Traverse	NB Silver Lake Rd./County Rd. 633 & US-31	I	2
*060	Grn Traverse	EB Riley Rd./Tenth St. & M-137	I	2
*061	Bay	SB 9 Mile Rd. & Beaver Rd.	I	2
062	Kent	SB Ramsdell Dr. & M-57/14 Mile Rd.	I	2
*063	Eaton	NB Ionia Rd. & M-50/Clinton Trail	I	2
064	Macomb	EB 23 Mile Rd. & Romeo Plank Rd.	I	2
*065	Livingston	NB Old US-23/Whitmore Lake Rd. & Grand River Rd.	I	2
066	Jackson	SWB Horton Rd. & Badgley Rd.	I	2
067	Kent	SB Belmont Ave. & West River Dr.	I	2
*068	Eaton	EB 5 Point Hwy. & Ionia Rd.	I	2
069	Allegan	WB 129th Ave. & 10th St.	I	2
*070	Eaton	EB M-43 & M-100	I	2
071	Ottawa	WB Taylor St. & 72nd Ave.	I	2
072	Bay	EB Cass Rd. & Farley Rd.	I	2
073	Allegan	EB 126th Ave. & 66th St.	I	2
074	Bay	NB Mackinaw Rd. & Cody-Estey Rd.	I	2
075	Jackson	EBD I-94 & Elm Ave. (Exit 141)	ER	2
076	Kent	NBD US-131 & 100th St. (Exit 72)	ER	2
*077	Ottawa	NBD I-196 & Byron Rd.	ER	2
*078	Kent	SBP US-131 & Hall St.	ER	2
079	Macomb	SBP M-53 & 26 Mile Rd.	ER	2
080	Bay	NBD I-75 & Wilder Rd. (Exit 164)	ER	2
081	Livingston	EBD I-96 & Fowlerville Rd. (Exit 129)	ER	2
*082	Macomb	EBP I-94 & 12 Mile Rd. (Exit 231)	ER	2
083	Jackson	WBD I-94 & Sargent Rd. (Exit 145)	ER	2
084	Allegan	NBP US-31/I-196 & Washington Rd./ Blue Star Hwy (Exit 47A)	ER	2
085	Genesee	SB Van Slyke Rd. & Maple Ave.	I	3
*086	Monroe	WB Ida Center Rd. & Summerfield Rd.	I	3
*087	Saginaw	WB Baldwin Rd. & Fowler Rd.	I	3
088	Calhoun	NB 23 Mile Rd. & V Drive N.	I	3
*089	Saginaw	WB Wadsworth Rd. & Portsmouth Rd.	I	3
*090	Lenawee	WB Slee Rd. & US-223	I	3
091	Van Buren	WB 36th Ave. & M-40	I	3

092	Van Buren	EB 63rd Ave. & County Rd. 652	I	3
093	Lapeer	WB McKeen Lake Rd. & Flint River Rd.	I	3
094	St. Joseph	NB Thomas Rd. & US-12	I	3
095	Saginaw	WB Rathbun Rd. & Moorish Rd.	I	3
*096	Berrien	NB Fikes Rd. & Coloma Rd.	I	3
*097	Genesee	WB Hegal Rd. & M-15/State Rd.	I	3
098	Lapeer	EB M-90 & M-90/M-53	I	3
099	Saginaw	NB Thomas Rd. & Swan Creek Rd.	I	3
100	Lenawee	WB Pixley Rd. & Deer Field Rd./Beaver Rd.	I	3
101	Van Buren	NB County Rd. 665 & M-40	I	3
102	Van Buren	WB County Rd. 374 & Red Arrow Hwy./St Joseph Rd..	I	3
103	Calhoun	SEB Michigan Ave./Austin Rd. & 28 Mile Rd./N. Eaton Rd.	I	3
*104	St. Clair	WB Norman Rd. & M-19/Emmett Rd.	I	3
105	Monroe	EB Oakville-Waltz Rd. & Sumpter Rd.	I	3
106	Berrien	WB Glenlord Rd. & Washington Ave.	I	3
107	Muskegon	NB Whitbeck Rd. & Fruitvale Rd.	I	3
*108	Monroe	SB Petersburg Rd. & Ida West Rd./Division Rd.	I	3
109	St. Clair	WB Masters Rd. & M-19	I	3
110	St. Joseph	SB Zinmaster Rd. & M-60	I	3
111	Shiawassee	NB State Rd. & Lansing Rd.	I	3
112	Van Buren	EB Celery Center Rd. & M-51	I	3
*113	Shiawassee	SB Geeck Rd. & M-21	I	3
114	Muskegon	SB Holton Duck Lake Rd. & Ryerson Rd./ Fourth St.	I	3
*115	Berrien	WB Glenlord Ave. & Hollywood Rd.	I	3
116	Lenawee	SB S. Piotter Hwy & Deer Field Rd.	I	3
117	Monroe	SBP I-75 & Front St./Monroe St. (Exit 13)	ER	3
*118	Lapeer	WBD I-96 & Nepessing Rd. (Exit 153)	ER	3
119	Lapeeer	EBP I-69 & Lake Pleasant Rd. (Exit 163)	ER	3
120	Berrien	WBD I-94 & US-33/M-63/Niles Rd. (Exit 27)	ER	3
*121	Van Buren	EBP I-94 & 64th St. (Exit 46, Hartford)	ER	3
122	Van Buren	EBD I-94 & County Rd. 652/Main St.(Exit 66)	ER	3
123	Muskegon	NBD US-31 & M-46/Apple St.	ER	3
*124	Van Buren	NBP I-196 & M-140 (Exit 18)	ER	3
*125	Calhoun	WBD I-94 & 26 Mile Rd.	ER	3
126	Monroe	NBP US-23 & Ida-West Rd. (Exit 13)	ER	3
127	Wayne	WB 8 Mile Rd. & Beck Rd.	I	4
*128	Wayne	EB Warren Rd. & Wayne Rd.	I	4
129	Wayne	EB McNichols Rd. & Woodward Ave.	I	4
*130	Wayne	NB Canton Center Rd. & Cherry Hill Rd.	I	4
131	Wayne	WB Ecorse Rd. & Pardee Rd.	I	4
132	Wayne	EB Michigan Ave. & Sheldon Rd.	I	4
*133	Wayne	EB Ecorse Rd. & Middlebelt Rd.	I	4
*134	Wayne	NB M-85/Fort Rd. & Emmons Rd.	I	4
135	Wayne	WB Glenwood Rd. & Wayne Rd.	I	4
136	Wayne	NB Haggerty Rd. & 7 Mile Rd.	I	4
*137	Wayne	WB 6 Mile Rd. & Inkster Rd.	I	4
138	Wayne	SB Inkster Rd. & Goddard Rd.	I	4

139	Wayne	SB Merriman Rd. & Cherry Hill Rd.	I	4
140	Wayne	SEB Outer Dr. & Pelham Rd.	I	4
*141	Wayne	NB Meridian Rd. & Macomb Rd.	I	4
142	Wayne	WB Ford Rd. & Venoy Rd.	I	4
*143	Wayne	SWB Vernor Rd. & Gratiot Rd.	I	4
144	Wayne	WB 5 Mile Rd. & Beck Rd.	I	4
145	Wayne	EB 7 Mile Rd. & Livernois Rd.	I	4
*146	Wayne	NB Gunston/Hoover Rd. & McNichols Rd.	I	4
147	Wayne	SB W. Jefferson/ Biddle Ave. & Southfield Rd.	I	4
148	Wayne	EB Goddard Rd. & Wayne Rd.	I	4
*149	Wayne	WB 8 Mile Rd. & Kelly Rd.	I	4
150	Wayne	SB Merriman Rd. & US-12/Michigan Ave.	I	4
151	Wayne	SB Telegraph Rd. & Plymouth Rd.	I	4
*152	Wayne	WB Sibley Rd. & Inkster Rd.	I	4
153	Wayne	NEB Mack Rd. & Moross Rd.	I	4
154	Wayne	WB Annapolis Rd. & Inkster Rd.	I	4
*155	Wayne	SB Greenfield Rd. & Grand River Rd.	I	4
156	Wayne	EB Joy Rd. & Livernois Rd.	I	4
157	Wayne	SEB Conner Ave. & Gratiot Rd.	I	4
158	Wayne	NWB Grand River Rd. & Wyoming Ave.	I	4
159	Wayne	WBP I-96 & Evergreen Rd.	ER	4
160	Wayne	WBP I-94 & Haggerty Rd. (Exit 192)	ER	4
*161	Wayne	NBD I-75 & Gibralter Rd. (Exit 29)	ER	4
162	Wayne	SBP I-75 & Southfield Rd.	ER	4
*163	Wayne	NBD I-275 & 6 Mile Rd. (Exit 170)	ER	4
164	Wayne	NBP I-275 & M-153/Ford Rd. (Exit 25)	ER	4
165	Wayne	NBD I-275 & Eureka Rd. (Exit 15)	ER	4
*166	Wayne	NBP I-75 & Springwells Ave. (Exit 45)	ER	4
167	Wayne	WBD I-94 & Pelham Rd. (Exit 204)	ER	4
168	Wayne	SBD I-75 & Sibley Rd.	ER	4

*Included in the Mini Survey Subsample

APPENDIX C

Calculation of Variances, Confidence Bands, and Relative Error

The variances for the belt use estimates were calculated using an equation derived from Cochran's (1977) equation 11.30 from section 11.8. The resulting formula was:

$$var(r) = \frac{n}{n-1}\sum_i (\frac{g_i}{g_k})^2(r_i-r)^2 - \frac{n}{N}\sum_i (\frac{g_i}{g_k})^2\frac{s_i^2}{g_i}$$

where $var(r_i)$ equals the variance within a stratum and vehicle type, n is the number of observed intersections, g_i is the weighted number of vehicle occupants at intersection I, g_k is the total weighted number of occupants for a certain vehicle type at all 42 sites (14 in the mini survey) within the stratum, r_i is the weighted belt use rate at intersection I, r is the stratum belt use rate, N is the total number of intersections within a stratum, and $s_i = r_i(1-r_i)$. In the actual calculation of the stratum variances, the second term of this equation is negligible. If we conservatively estimate N to be 2000, the second term only adds 2.1 x 10^{-6} units to the largest variance (Stratum 4). This additional variance does not significantly add to the variance captured in the first term. Therefore, since N was not known exactly, the second term was dropped in the variance calculations. The overall estimated variance for each vehicle type was calculated using the formula:

$$var(r_{all}) = \frac{var(r_1)+var(r_2)+var(r_3)+0.88^2 \times var(r_4)}{3.88^2}$$

The Wayne County stratum variance was multiplied by 0.88 to account for the similar weighting that was done to estimate overall belt use. The 95 percent confidence bands were calculated using the formula:

$$95\% \; Confidence \; Band = r_{all} \pm 1.96 \times \sqrt{Variance}$$

43

where *r* is the belt use of interest. This formula is used for the calculation of confidence bands for each stratum and for the overall belt use estimate.

Finally, the relative error or precision of the estimate was computed using the formula:

$$RelativeError = \frac{StandardError}{r_{all}}$$

The federal guidelines (NHTSA, 1992, 1998) stipulate that the relative error of the belt use estimate must be under 5 percent.