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Safety Belt Use in Wayne County Communities: Fall 2001

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16. Abstract

Results of a direct observation survey of safety belt use in a six community area of Wayne County, Michigan, conducted in the fall of 2001, are reported here . The six communities included in the survey area were: Brownstown Township, Dearborn, Detroit, Livonia, Romulus, and Taylor. In this study, 3,113 occupants traveling in four vehicle types (passenger cars, sport-utility vehicles, vans/minivans, and pickup trucks) were surveyed during September, 2001. Belt use was estimated for all commercial/noncommercial vehicle types combined and separately for each vehicle type. Belt use by seating position, sex, time of day, and age was also calculated. Overall belt use was 75.4 percent. Belt use was 77.6 percent for passenger cars, 73.3 percent for sport-utility vehicles, 77.0 percent for vans/minivans, and 68.8 percent for pickup trucks. Overall belt use was higher for females than for males, and higher for drivers than for passengers. In general, belt use was highest during the morning commute, was low for 16-to-29-year olds, and increased with age. These findings enable us to examine and measure safety belt use trends in the six communities, and to assess the effects of Public Information and Education programs. This study is superior to the statewide survey for assessing the effects of local programs in the six community area since it focuses entirely on local traffic.

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INTRODUCTION

There are many factors that influence safety belt use in a specific area: presence of a safety belt use law, enforcement provision of the law, presence of effective programs to promote belt use, level of police enforcement, socio-economic status, and the demographics of motorists in the area, to name a few. To assess the effectiveness of a program designed to increase safety belt use in a certain area, it is necessary to understand all of these factors, and to realize that a change in one of these factors could dramatically affect the level of safety belt use in that area. It is also critical to understand that safety belt use in one community may be widely different from belt use in a neighboring community due to differences in these factors. Therefore, the best way to measure the effectiveness of a program designed to increase belt use in a certain area, is to observe belt use in that specific area before the implementation of the program, and again after program completion.

The Michigan Office of Highway Safety Planning (OHSP) received funding from the National Highway Traffic Safety Administration (NHTSA) to implement programs designed to increase safety belt use in the Wayne County area. The Wayne County Safety Belt Project is a broad based, multi-year campaign designed to educate and train the public, law enforcement officers, and judges in the importance of safety belt and child passenger restraint use. Police enforcement and community awareness programs were also implemented as part of this project (OHSP, 2000). This type of community-based program may have the greatest potential for reaching segments of the population that disregard safety belt use. To be most effective, the program must be tailored to the specific characteristics of the six communities within Wayne County that are participating in this project: Brownstown Township, Dearborn, Detroit, Livonia, Romulus, and Taylor.

Wayne County is one of the most unique counties in Michigan. Established in 1796 as part of the Northwest Territories, the county's borders originally stretched from the focal point of Detroit, through nearly all of Michigan along with parts of Illinois, Indiana, and Wisconsin (Wayne County Government, 2000). Presently, Wayne County encompasses 622 square miles in southeast Michigan (Universal Map, 1990). Wayne County accounts

for more than 20 percent of the state's total population (US Bureau of the Census, 2000), but only about 1 percent of the state's geographic area (Universal Map, 1990). While Wayne County represents a very unique section of Michigan, the different communities that comprise the county are also quite diverse.

The history of Detroit is closely tied to the history of Wayne County. Detroit was founded in 1701 as a French fort. The unique landscape along the Detroit River presented an ideal location for expansion and trade. By 1850, Detroit's population had grown to about 21,000 people, with shipping as its most important industry. By the early twentieth century, Detroit saw the beginning of a manufacturing boom and the birth of the automobile industry (Universal Map, 1990). Today, with a population of more than 950,000 residents, Detroit is the hub of southeastern Michigan and the tenth largest city in the United States (US Bureau of the Census, 2000).

Participating in the Wayne County Safety Belt Project for the first time this year, Brownstown Township is situated southwest of Detroit, a few miles from the Detroit River. Founded in 1827 as one of nine original townships formed in Wayne County, Brownstown is described as a quiet community. Encompassing about 23 square miles, Brownstown has about 23,000 residents (Wayne County Government, 2000).

Situated near the center of Wayne County, Dearborn was founded in 1928. Known as the World Headquarters for Ford Motor Company, Dearborn has a population of over 97,000 people (Wayne County Government, 2000). Dearborn boasts several world-renowned attractions including Greenfield Village and Henry Ford Museum. The diverse population of this city includes more than 70 different nationalities (City of Dearborn, 2001).

Although Livonia began as a rural farm community, there are now more than 5,000 businesses throughout this city. With the second largest population in Wayne County, Livonia is recognized as the fifth safest city in the US (City of Livonia, 2000). Encompassing almost 36 square miles, there are over 1,800 acres set aside as park land and open space (Wayne County Government, 2000).

Another Wayne County community participating in this project is Taylor. Taylor was incorporated as a city in 1968, but this community dates back to the 1800s. Similar to many Wayne County communities, Taylor began as an agricultural area. However, this city has seen impressive growth in industry and commercial development which now provides much of the employment for the city's residents (City of Taylor, 2001).

The city of Romulus is participating in the Wayne County Safety Belt Project for the first time this year. While parts of this city remain rural, the presence of the Detroit Metropolitan Wayne County Airport have led to the development and urbanization of much of the city. With industrial and commercial development mostly around the airport, along with scattered single family residences throughout the city, Romulus is a very distinctive city in Wayne County (Wayne County Government, 2000).

As these facts illustrate, Wayne County, and many of the communities that make up Wayne County, are very unique. Every September, the University of Michigan Transportation Research Institute (UMTRI) conducts a statewide direct observation survey of safety belt use in Michigan. Included in this survey is the Wayne County area; however, these observations reflect a belt use rate for Wayne County collectively, and do not differentiate one area from another. The participation of specific communities in the Wayne County Safety Belt Project highlights the importance of measuring safety belt use in these specific areas. Given the widely differing demographic, socio-economic, and level of urbanization of the participating communities, the use of the overall Wayne County belt use rate as an average might overlook a change that occurred in one community, but was not observable in the overall county rate.

The current survey provides data for both assisting in the development of appropriate safety belt promotion programs in specific Wayne County communities, and evaluating the effectiveness of existing programs. The design of this survey focuses exclusively upon belt use on local roads in the six Wayne County communities. Thus, the survey provides data to closely track changes in belt use in the populations most likely to be influenced by the programs developed by the Michigan Office of Highway Safety Planning.

METHODS

Sample Design

The sample design for the present survey was closely based upon the one used by Streff, Eby, Molnar, Joksch, and Wallace (1993). While the entire sampling procedure is presented in the previous report, it is repeated here for completeness, with modifications noted.

The purpose of the study was to assess the safety belt use rate in a six-community area in Wayne county[1]. This area consisted of the following communities: Brownstown Township, Dearborn, Detroit, Livonia, Romulus, and Taylor. Because communities were sampled collectively, individual safety belt use rates calculated for each community may not be representative of a community's belt use rate. Separate community safety belt use rates are presented only as a way of tracking the effectiveness of belt use programs in each of the six communities.

Observation sites for the study were selected using a procedure that ensured an equal probability of selection for every roadway intersection within the borders of the six communities. To begin, detailed equal-scaled road maps of the Detroit Metropolitan Area were obtained. The six communities were included in 30 of the maps. Each map was numbered and overlaid with a grid pattern. The grid dimensions were 86 lines horizontally and 69 lines vertically. The lines of the grid were separated by approximately 1/8 inch. The maps were approximately *1 7/8 inch:mile* scale, thus creating grid squares that were .07 miles per side. Each grid square was uniquely identified by two numbers, a horizontal (or *x*) coordinate and a vertical (or *y*) coordinate.

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[1]The study was originally designed with 5 cities. One of the cities has since dropped out of the survey, while two additional communities have been added. The same procedures were followed for site selection in the additional two communities.

The 41 sites in the survey were chosen sequentially, by first randomly selecting a map number containing one of the cities in the sample[2]. To select a map, a number between 1 and 30 was randomly chosen and the corresponding map was delineated as the area from which a site would be selected. Once the map was selected, a random *x* and a random *y* coordinate were chosen and the corresponding grid square identified. If the chosen grid square contained an intersection that was within the boundary of one of the five cities, that intersection was marked as the observation site. An alternate map number was randomly generated if the grid square did not contain an intersection, or if the intersection did not fall within the boundary of one of the six communities. This process was repeated until an eligible intersection was identified. Site numbers were assigned in numerical order, following this same process, until 41 sites had been selected.

Once all of the sites were selected, the street and direction of traffic flow to be observed was determined. The street to be observed was randomly assigned via a coin flip. The direction of traffic flow was also assigned using this method. All sites were visited by the field supervisor to determine if observations were possible. Each site was required to have a traffic control device, and traffic flow in the lane that had been designated as the observation lane. If the street designated as the observation street did not have a traffic control device, the other street in the intersection was assigned as the street to be observed. In a similar manner, if it was not possible to observe the traffic flow in the direction chosen during site selection, the opposite direction was assigned for observation. For example, if northbound Second Street was to be observed, and Second Street was a one-way street with traffic flowing south, the southbound traffic was assigned as the direction to be observed.

For each primary intersection site, an alternate site was also selected. The alternate sites were determined by counting the number of eligible intersections within a one mile radius around the primary site. These intersections were assigned a number. A random number was then generated, between 1 and the total number of eligible intersections, and

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[2]It should be noted that this step does not constitute an additional stage of sampling. It is simply a convenient method for randomly selecting a grid square from several pages of sequential grids.

the corresponding intersection was assigned as the alternate site. The observer location at the alternate intersection was determined in the same way as at the primary site.

The day of week and time of day for site observation were randomly assigned to sites in such a way that all days of the week and all daylight hours (7:00 a.m. - 7:00 p.m.) 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, the 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 the cluster was to be observed was randomly determined. After taking into consideration the time required to finish all sites before darkness, a random starting time for the day was selected. In addition, a random number between one 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 a clockwise direction. Because of various scheduling limitations (e.g., observer availability, number of hours worked per week), certain days were selected that could not be observed. When this occurred, a new day was randomly selected until a usable one was found. The important issue regarding randomization is that the day and time assignments to the sites were not correlated with belt use at a site. This method is random with respect to this issue.

Table 1 shows descriptive statistics for the 41 observation sites. As shown in this table, the observations were fairly well distributed over time of day, with the exception of very early mornings and evenings; and day of week, with the exception of Friday. 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, it was included in the later time slot. This table also shows that nearly every site observed was the primary site, and the majority of observations occurred on sunny days.

Table 1. Descriptive Statistics for the 41 Observation Sites							
Day of Week		**Observation Period**		**Site Choice**		**Weather**	
Monday	24.4%	7-9 a.m.	9.8%	Primary	97.6%	Sunny	56.1%
Tuesday	17.1%	9-11 a.m.	24.4%	Alternate	2.4%	Cloudy	34.1%
Wednesday	9.7%	11-1 p.m.	19.5%			Rain	9.8%
Thursday	17.1%	1-3 p.m.	26.8%			Snow	0.0%
Friday	0.0%	3-5 p.m.	17.1%				
Saturday	9.8%	5-7 p.m.	2.4%				
Sunday	21.9%						
TOTALS	100%		100%		100%		100%

Data Collection

Data collection for the study involved direct observation of vehicle type, whether or not the vehicle was used for commercial purposes, shoulder belt use, estimated age, and sex for both the driver and front-right passenger. 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 September 15 through September 20, 2001. Observations 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, 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 designated for observers to sketch the intersection and 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.

The 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 every 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-right passenger present. Furthermore, whether or not the vehicle was used for commercial purposes was also recorded. 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. 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

Every site in the sample was visited by one observer for a period of 1 hour, with the exception of sites in the city of Detroit, and sites in other communities observed during the same day as the Detroit sites. To address potential security concerns, Detroit sites were visited by two-person teams of observers for a period of 30 minutes. Because each team member at Detroit sites recorded data for different lanes of traffic, the total amount of data collection time at Detroit sites was equivalent to that at other sites.

Upon arrival at a site, observers determined whether observations were possible there. If observations were not possible (e.g., due to construction in the designated observation lane), 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 regardless of the number of lanes present. At sites visited by two-person teams, team members observed different lanes of the same traffic leg (either standing with one observer on the curb and one observer on the median, if there was more than one traffic lane and a median, or on diagonally opposite corners of the intersection).

At each site, observers conducted a 5-minute count of all eligible vehicles on 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 possible. If traffic flow was heavy, observers were instructed to record data for the first eligible vehicle they saw, 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 5 days of intensive training 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. The manual included a site schedule identifying the location, date, time, and traffic leg to be observed for each site (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 these 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 lane to observe, conducting the vehicle count, recording safety belt use, estimating age and sex, and differentiating between commercial and noncommercial vehicles. 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 consistency. Teams were rotated throughout the training to ensure that each observer was paired with every other observer at least eight times. Each observer pair practiced recording safety belt use, sex, age, and vehicle information 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 mark 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 identified. 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 drop off 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 at home 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 site description forms about site-specific characteristics that might affect future surveys (e.g., traffic flow patterns, traffic control devices, site access).

Data Processing and Estimation Procedures

Data from the site description and observation forms 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, computer analysis programs 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.

The goal of this safety belt survey was to estimate belt use for the six community area in Wayne County, Michigan based on vehicle miles of travel (VMT). 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[3]. The resulting number was the estimated number of vehicles passing 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 the six community area of Wayne County, Michigan was determined by calculating the belt use rate for observed vehicle occupants in all vehicle types using the following formula:

$$r = \frac{Total\ Number\ of\ Belted\ Occupants,\ weighted}{Total\ Number\ of\ Occupants,\ weighted}$$

[3] 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.

The totals are the sums across all 41 sites after weighting, and occupants refers only to front-outboard occupants.

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.

RESULTS

Overall Safety Belt Use

As shown in Figure 1, 75.4 ± 3.0 percent of all front-outboard occupants traveling in commercial/noncommercial passenger cars, sport utility vehicles, vans/minivans, or pickup trucks on local roads in the six community area of Wayne County, Michigan during September 2001 were restrained with shoulder belts. 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 72.4 percent and 78.4 percent.

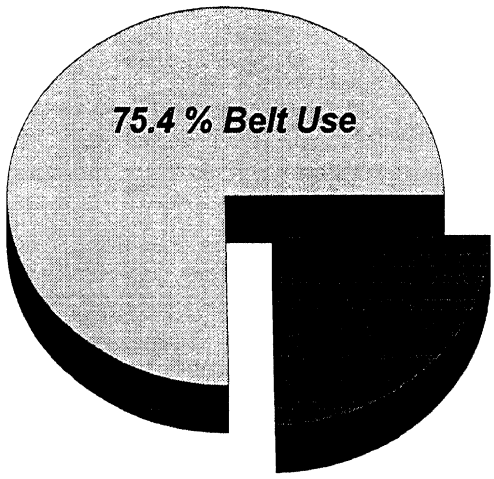

Figure 1. Front-Outboard Shoulder Belt Use in a Six Community Area of Wayne County, Michigan.

Table 2 shows shoulder belt use rates and unweighted number of occupants by vehicle type in the six community area of Wayne County, Michigan. A statistical analysis reveals that belt use does not significantly differ between the four vehicle types. Note that the unweighted number of occupants is fairly low for all vehicle types except for passenger cars. Thus, it is not possible to calculate meaningful safety belt use rates by those vehicle types for any subcategories. Therefore, the remaining results are presented with all vehicle types combined.

Table 2. Percent Shoulder Belt Use and Unweighted Number of Occupants by Vehicle Type in the Six Community Area of Wayne County, Michigan		
Vehicle Type	**Percent Use**	**Unweighted N**
Passenger	77.6 ± 3.2 %	1,755
Van/Minivan	77.0 ± 6.6 %	427
Sport Utility	73.3 ± 5.0 %	422
Pickup Truck	68.8 ± 5.7 %	509
All Vehicles Combined	**75.4 ± 3.0 %**	3,113

Estimated Safety Belt Use by Seating Position

Estimated safety belt use rates by seating position are shown in Figure 2. As is typically found in Michigan (Eby, Molnar, & Olk, 2000; Eby, Vivoda, & Fordyce, in press), driver belt use was higher than passenger belt use.

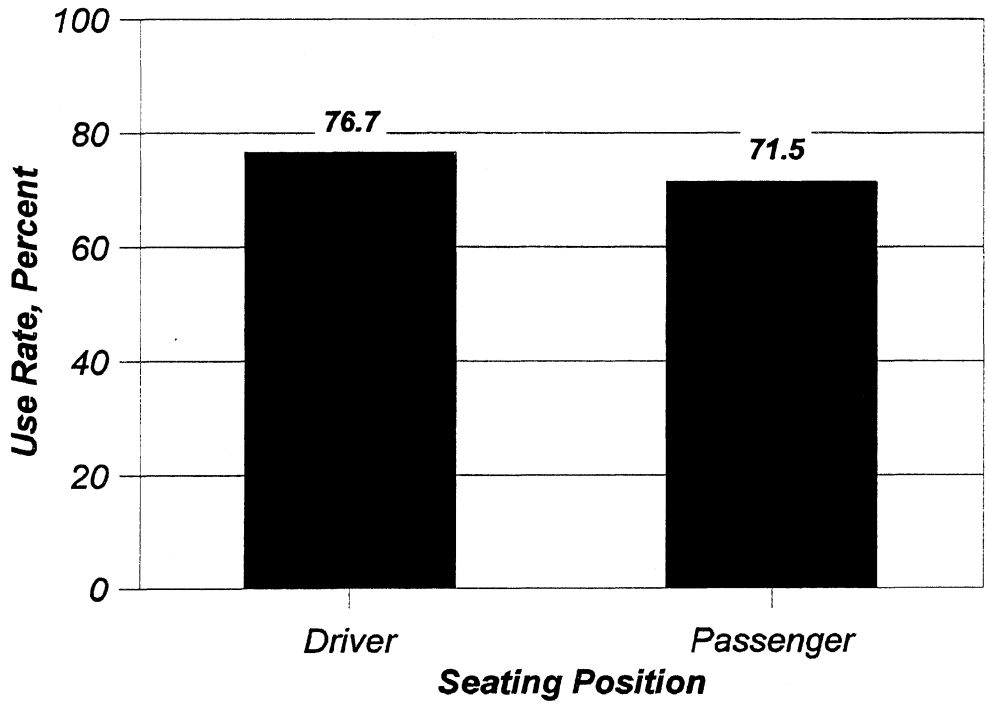

Figure 2. Front-Outboard Shoulder Belt Use by Seating Position in the Six Community Area of Wayne County, Michigan.

Estimated Safety Belt Use by Sex

Estimated safety belt use rates by sex for the six community area of Wayne County, Michigan are shown in Figure 3. Female belt use is higher than male belt use, with a difference of 5.1 percentage points. This finding is consistent with a large body of research on safety belt use by sex (see Eby, Molnar, & Olk, 2000; Eby, Vivoda, & Fordyce, in press, for a review).

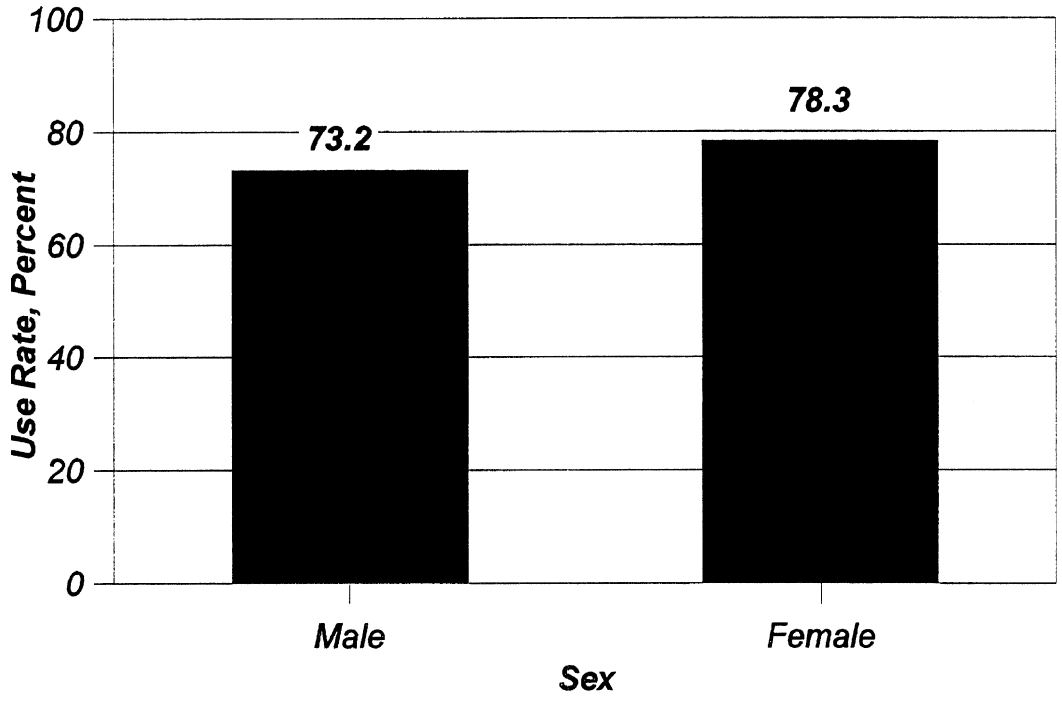

Figure 3. Front-Outboard Shoulder Belt Use by Sex in the Six Community Area of Wayne County, Michigan.

Estimated Safety Belt Use by Time of Day

The estimated safety belt use rates in the six community area of Wayne County, Michigan by time of day are shown in Figure 4. Safety belt use was highest during the morning rush hour and seemed to decline during the evening rush hour.

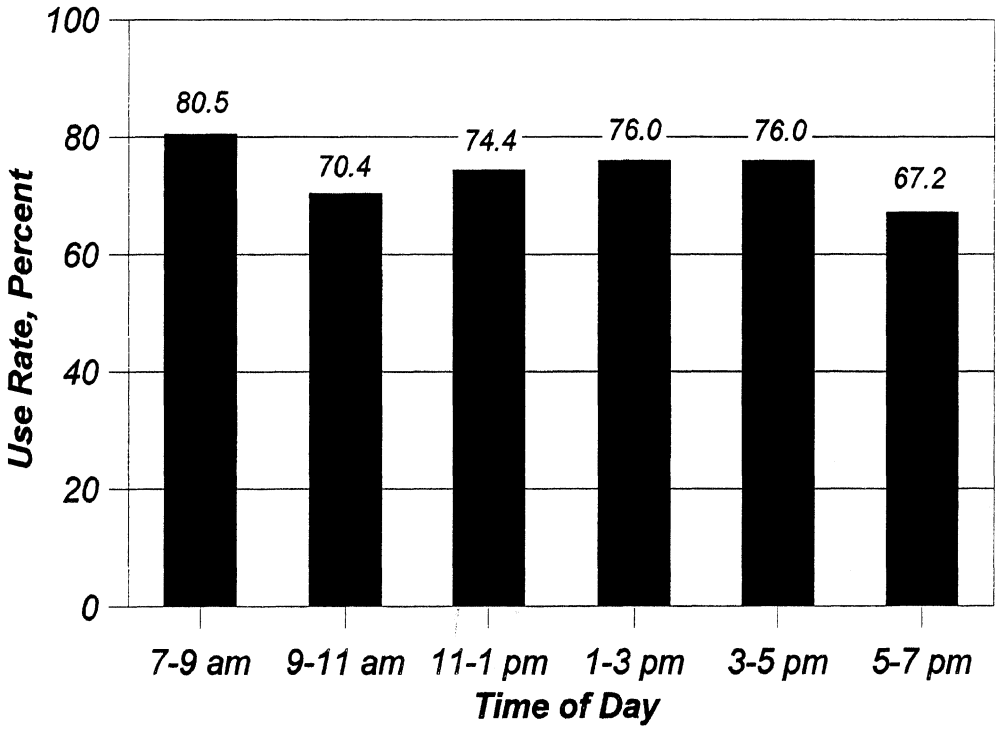

Figure 4. Front-Outboard Shoulder Belt Use by Time of Day in the Six Community Area of Wayne County, Michigan.

Estimated Safety Belt Use by Age

Estimated safety belt use rates by age are shown in Figure 5. Following NHTSA (1998) guidelines, children traveling in child safety seats are not included in this survey. As such only one child in the 0-to-3-year-old age group was observed in the study, thus no meaningful interpretations can be made concerning belt use in this age group. Consequently, all figures exclude this age group. Additionally, there were only 131 children in the 4-to-15-year-old age group observed in the front-outboard position. Therefore, the rates calculated for these age groups should be interpreted with caution. Excluding these age groups, we find that belt use is lowest for 16-to-29-year olds, with higher rates of safety belt use observed in the older age groups. This trend was also found in the recent statewide survey of safety belt use (Eby & Vivoda, 2001).

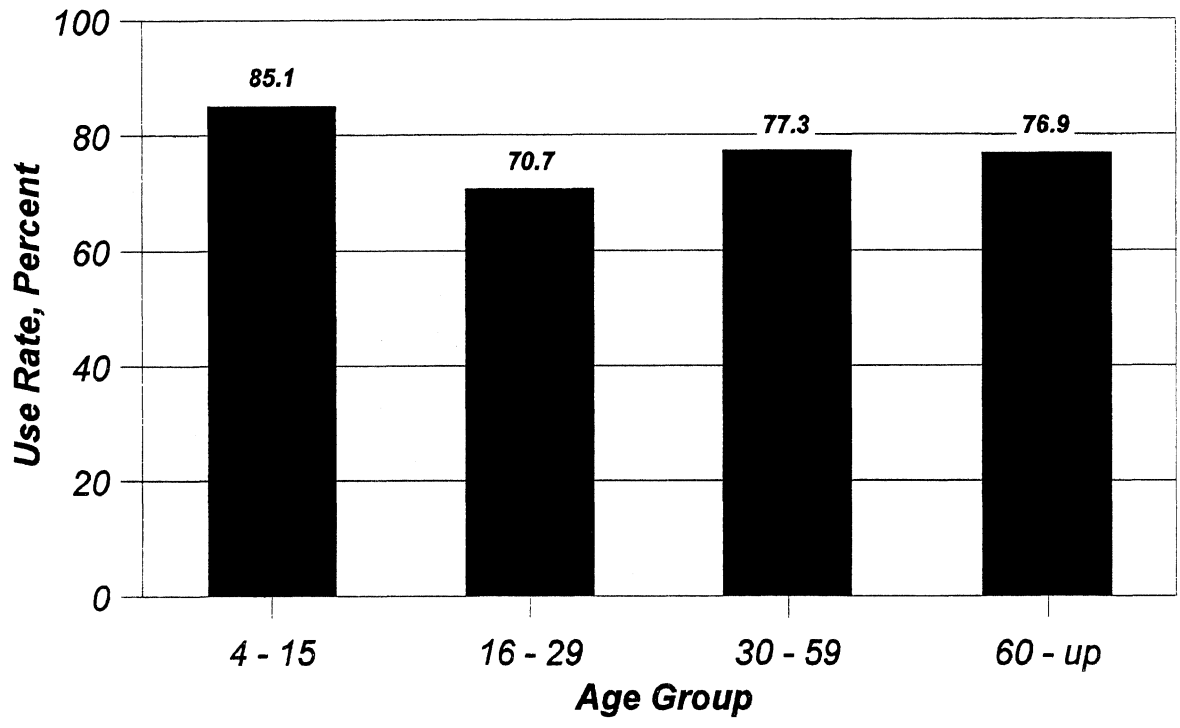

Figure 5. Front-Outboard Shoulder Belt Use by Age Group in the Six Community Area of Wayne County, Michigan.

Estimated Safety Belt Use by Age and Sex

Shown in Figure 6 are the estimated safety belt use rates by age group and sex. Again, the rates for the two youngest age groups are based on very low observation numbers; these calculated rates are not statistically meaningful and should be interpreted with caution. Excluding these age groups, we find that male safety belt use rates are lower than the rates for females in all age groups. Figure 6 also indicates that within each sex, safety belt use rates are higher for occupants in the 30-to-59 and 60-years and older age groups, than for the 16-to-29 year old age group.

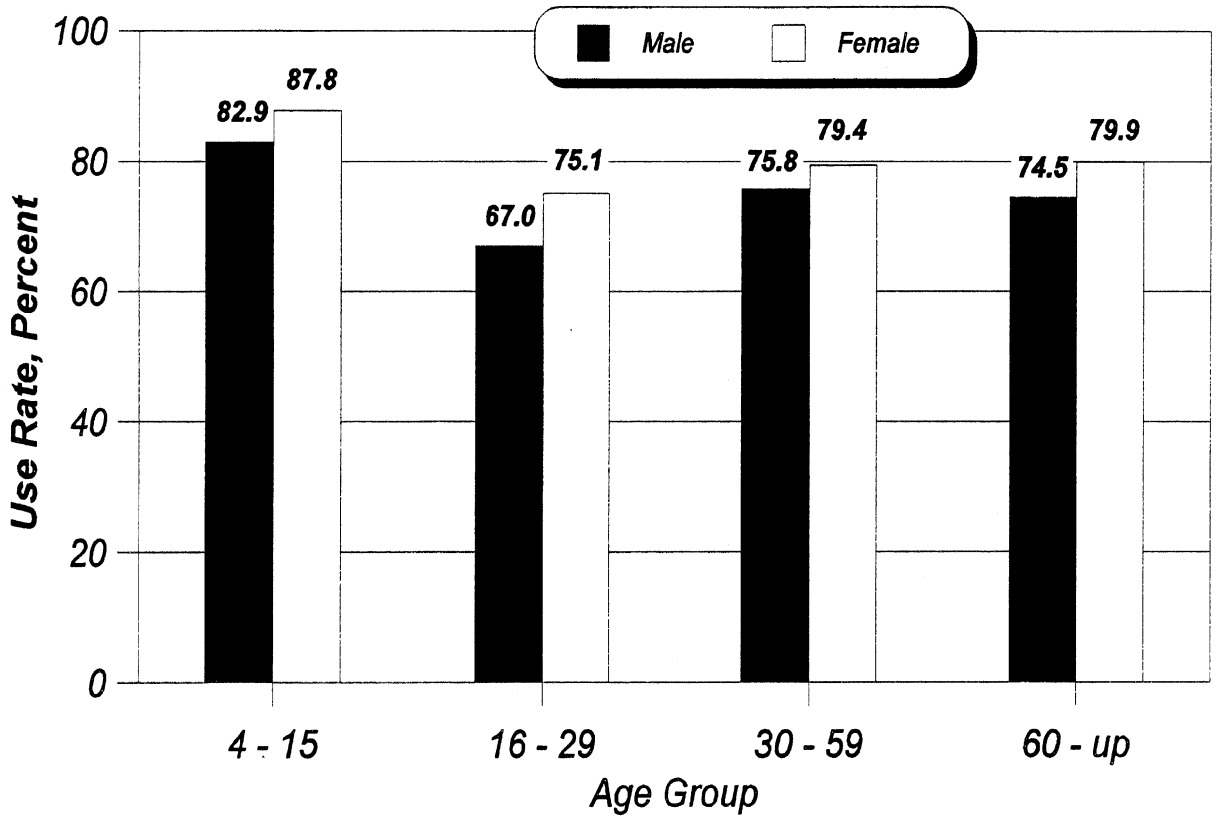

Figure 6. Front-Outboard Shoulder Belt Use by Age and Sex in the Six Community Area of Wayne County, Michigan.

Estimated Safety Belt Use by Community

In order to measure the effects of safety belt use programs that are community specific, we have calculated safety belt use rates for each community separately. It should be noted that the sample was designed to determine safety belt use across the six-community area. Therefore, the community-by-community numbers reported here may not be representative of communitywide belt use, and therefore must be interpreted with caution. Table 3 shows the safety belt use rates and unweighted numbers of observations by community. The highest safety belt use rate was observed in Romulus, and the lowest was noted in Detroit. The statistical analysis reveals that the safety belt use rates in both Brownstown Township and Romulus were significantly higher than the rates in both Detroit and Taylor. However, given the relatively small number of observations in several communities and the resultant large margins of error, no other significant differences were observed.

Table 3. Percent Shoulder Belt Use and Unweighted Number of Occupants by Community in Wayne County, Michigan

Community	Percent Use	Unweighted N
Brownstown Township	78.6 ± 3.7 %	899
Dearborn	70.9 ± 14.4 %	269
Detroit	66.9 ± 6.7 %	624
Livonia	77.1 ± 3.9 %	249
Romulus	79.3 ± 3.8 %	728
Taylor	71.4 ± 2.3 %	344

TRENDS

Overall Safety Belt Use by Year

As shown in Figure 7, 75.4 ± 3.0 percent of all front-outboard occupants traveling in commercial/noncommercial passenger vehicles, sport utility vehicles, vans/minivans, or pickup trucks on local roads in the six community area of Wayne County, Michigan during September 2001 were restrained with shoulder belts. This result indicates that safety belt use in the six community area has remained about the same over the last year[4]. However, an analysis of the current rate compared to the rate observed prior to standard (primary) enforcement, implemented March 10, 2000, reveals an increase of nearly 21 percentage points.

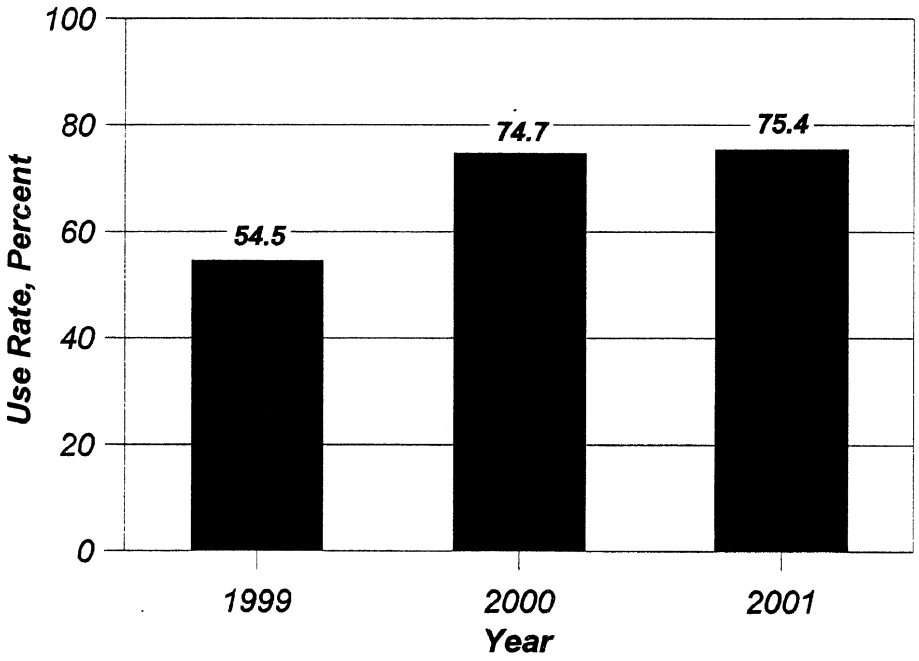

Figure 7. Front-Outboard Shoulder Belt Use by Year in a Six Community Area of Wayne County, Michigan.

[4]The surveys conducted in 1999 and 2000 included the city of Westland. The addition of Brownstown Township and Romulus in the current survey, along with the removal of Westland, make overall comparisons between the current survey and previous years difficult.

Estimated Safety Belt Use by Seating Position and Year

Estimated safety belt use rates by seating position and year are shown in Figure 8. As is typically found in Michigan (Eby, Molnar, & Olk, 2000; Eby & Vivoda, 2001; Eby, Vivoda, & Fordyce, in press), driver belt use was higher than passenger belt use for all three survey years. A significant increase was observed in both seating positions since standard enforcement was implemented.

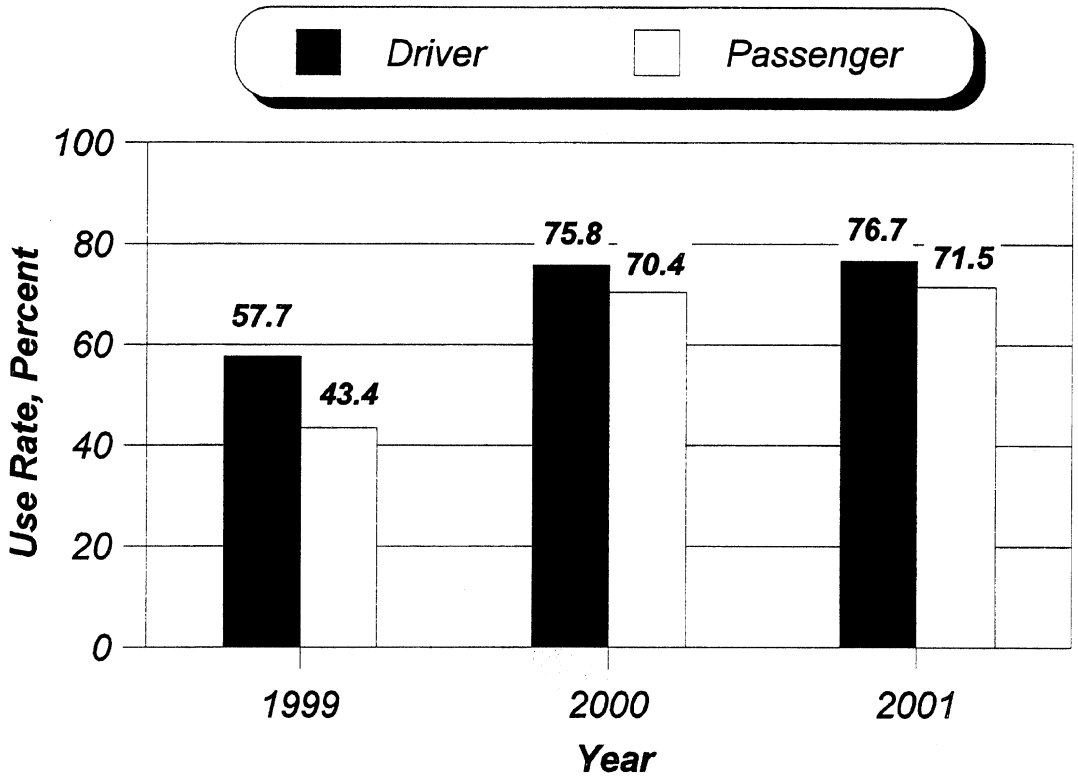

Figure 8. Front-Outboard Shoulder Belt Use by Seating Position and Year in the Six Community Area of Wayne County, Michigan.

Estimated Safety Belt Use by Sex and Year

The estimated safety belt use rates by sex and year for the six community area of Wayne County, Michigan are shown in Figure 9. While safety belt use increased for both sexes since 1999, the overall difference between the two appears to have decreased. While female belt use appears to have declined slightly since 2000, this difference is not significant.

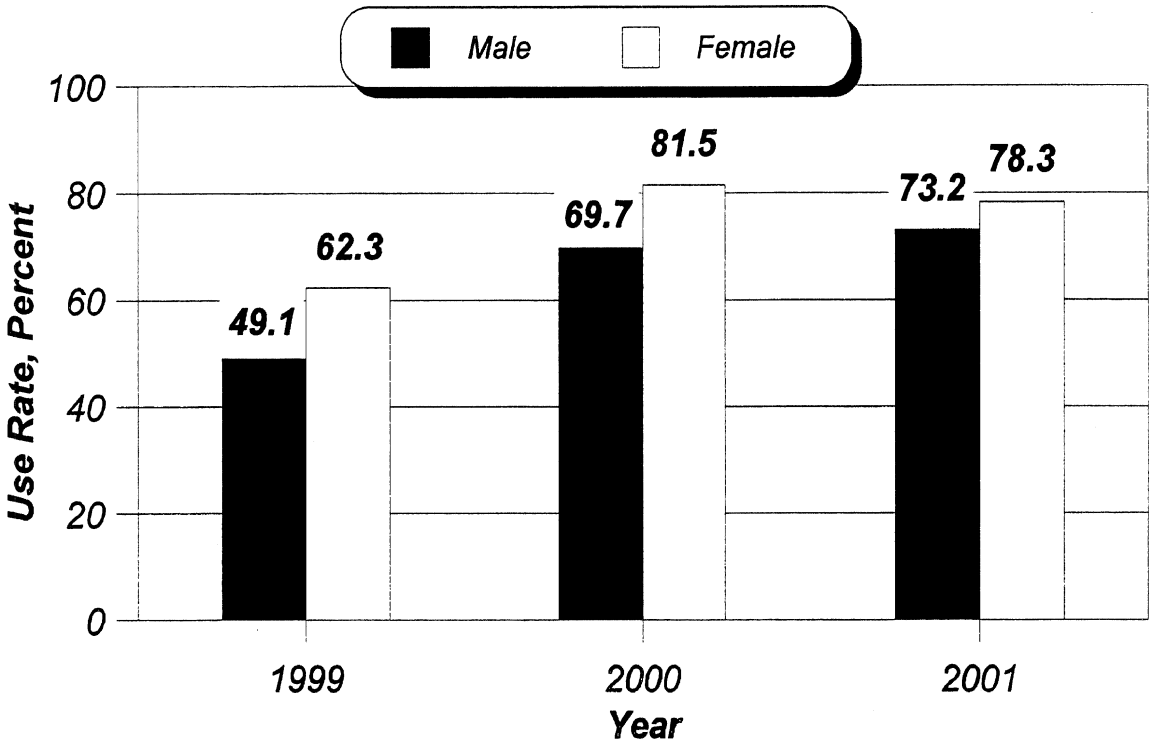

Figure 9. Front-Outboard Shoulder Belt Use by Sex and Year in the Six Community Area of Wayne County, Michigan.

Estimated Safety Belt Use by Time of Day and Year

The estimated safety belt use rates in the six community area of Wayne County, Michigan by time of day and year are shown in Figure 10. While the surveys conducted in 1999 and 2000 did not include observations after 5 pm, the random assignment of times during the redesign of the 2001 survey yielded some observation times after 5 pm. While safety belt use rates were significantly higher for all times in both surveys conducted since the implementation of standard enforcement, similar trends were noted in all three years; safety belt use was highest during the morning rush hour and declined near the end of the day.

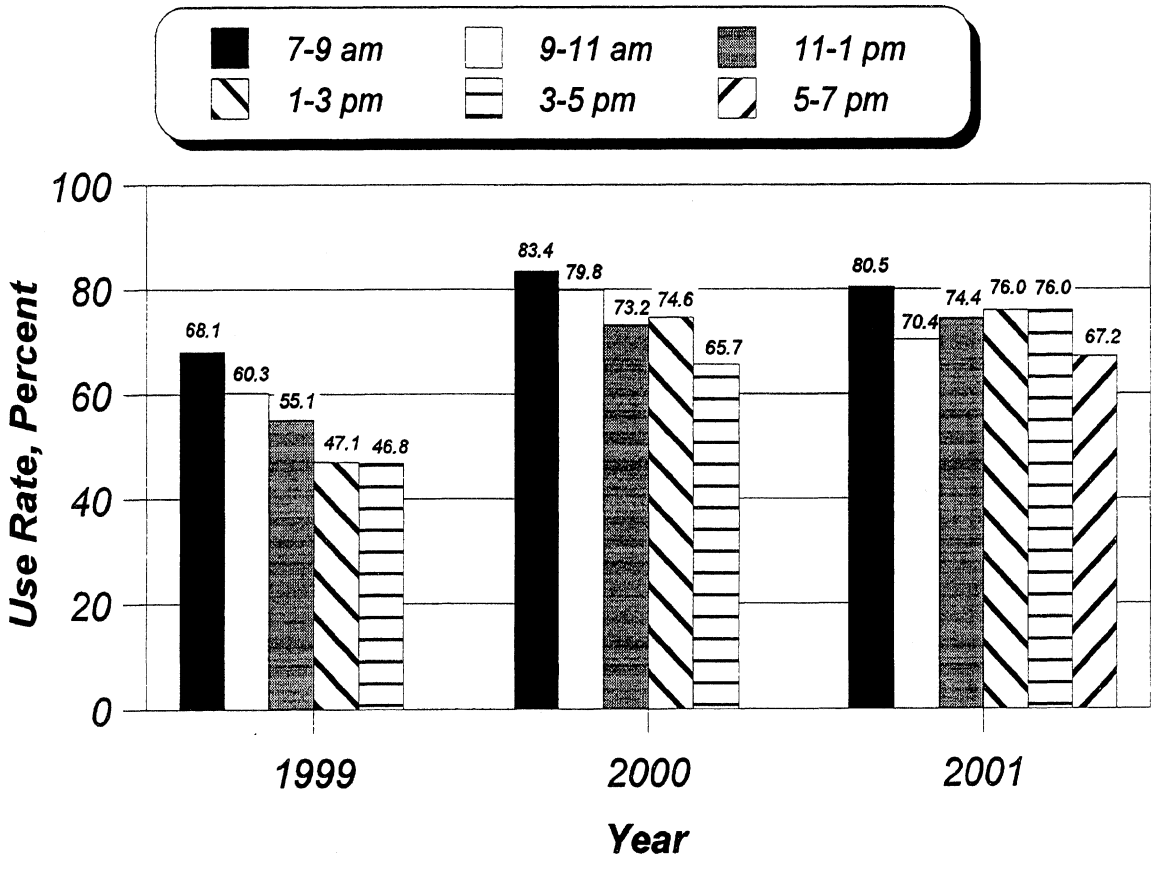

Figure 10. Front-Outboard Shoulder Belt Use by Time of Day and Year in the Six Community Area of Wayne County, Michigan.

Estimated Safety Belt Use by Age and Year

Estimated safety belt use rates by age is shown in Figure 11. Excluding the two youngest age groups, for reasons previously discussed, belt use is lowest in the 16-to-29-year old age group for 1999, 2000, and 2001. For all three years, higher belt use was observed in the two oldest age groups. While safety belt use rates for 2000 and 2001 were significantly higher than rates for 1999, the most notable increase was observed in the 16-to-29 year old age group, with a total increase of 25.5 percentage points in the current survey.

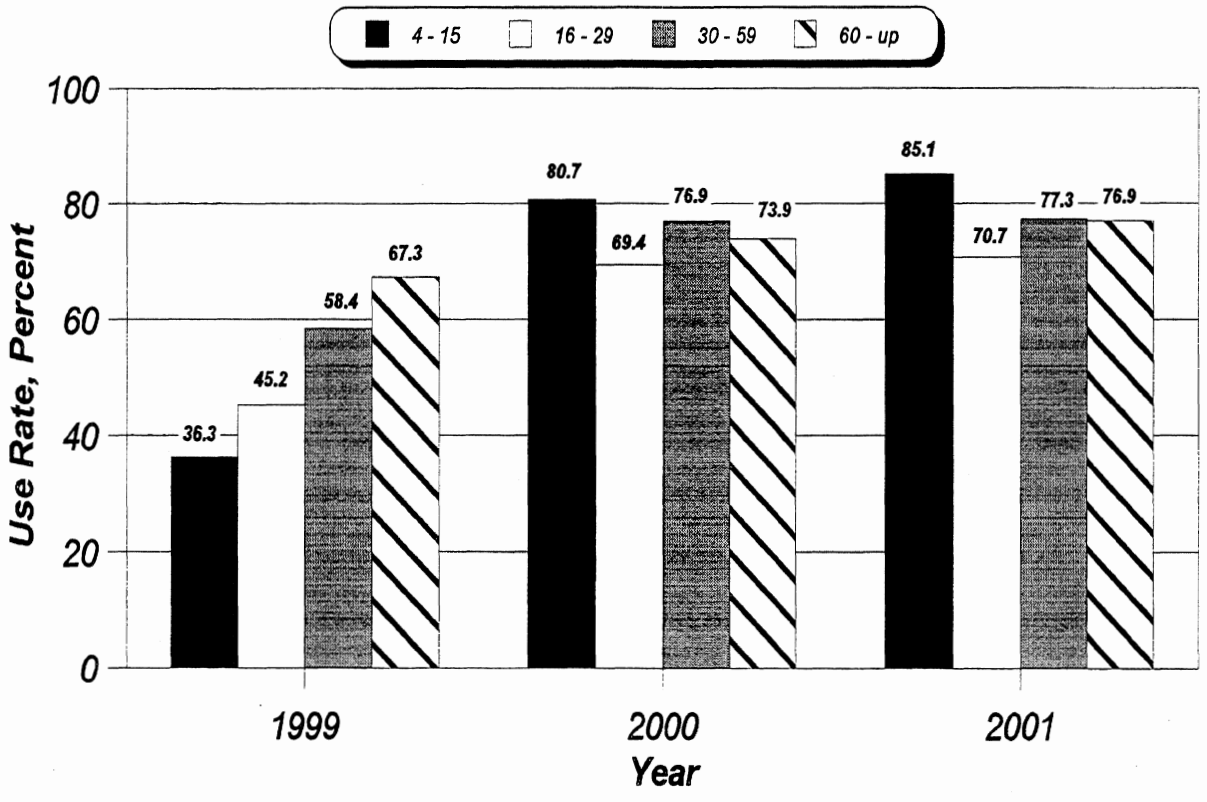

Figure 11. Front-Outboard Shoulder Belt Use by Age Group and Year in the Six Community Area of Wayne County, Michigan.

Estimated Safety Belt Use by Sex, Age, and Year

Shown in Figures 12 and 13 are the estimated safety belt use rates by sex, age group, and year. For all years, the rates for the two youngest age groups are based on very low observation numbers and therefore are not meaningful. Excluding these age groups, we find that male belt use rates are considerably lower than the rates for females for all age groups in 1999, 2000, and 2001. Within each sex and across all years, the use rates are highest for the two oldest age groups.

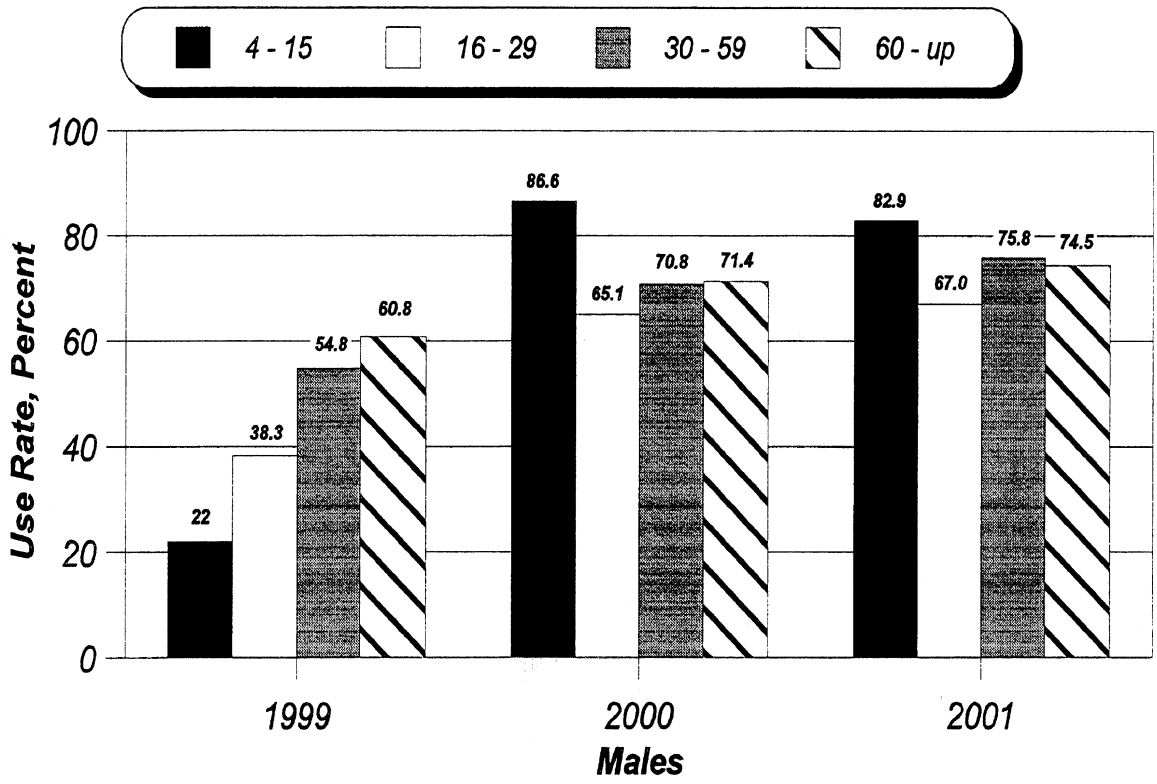

Figure 12. Front-Outboard Shoulder Belt Use for Males by Age and Year in the Six Community Area of Wayne County, Michigan.

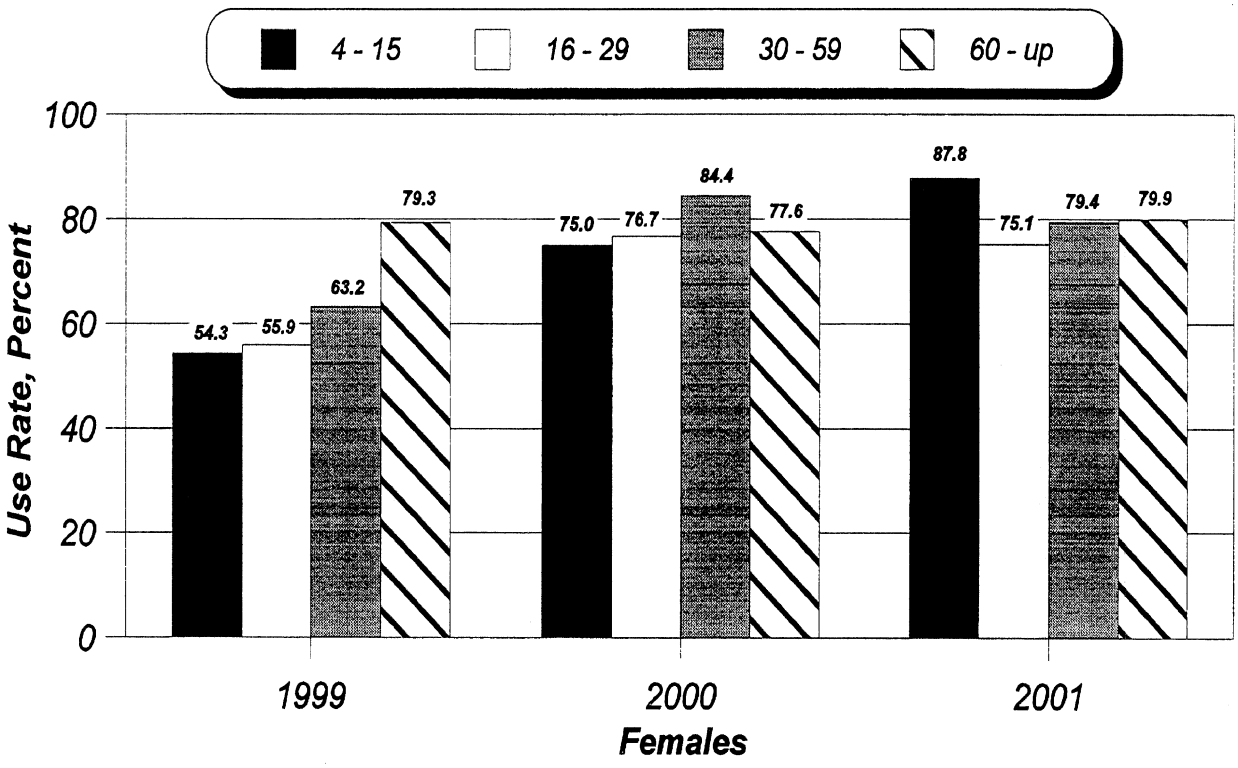

Figure 13. Front-Outboard Shoulder Belt Use for Females by Age and Year in the Six Community Area of Wayne County, Michigan.

Estimated Safety Belt Use by Community and Year

Figure 14 shows the safety belt use rates by community and year[5]. In the current survey, the two communities that were added this year, Brownstown Township and Romulus, had the highest belt use rates. Of the remaining four communities, there appear to be increases in belt use over the past year in both Livonia and Dearborn, while slight declines were noted in Taylor and Detroit; however, these changes were not statistically significant. The current rates for these communities continue to be much higher than the rates observed prior to the implementation of standard enforcement.

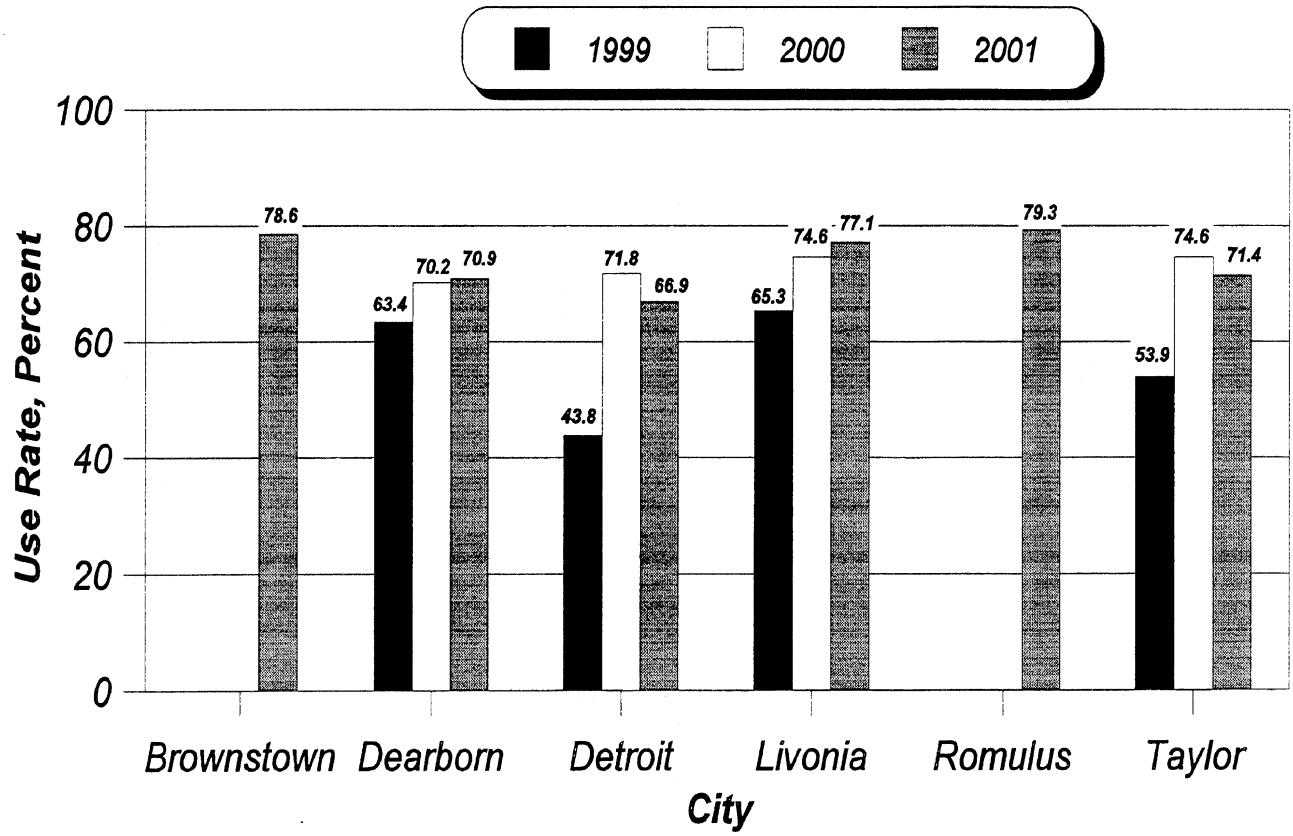

Figure 14. Front-Outboard Shoulder Belt Use by Community and Year in the Six Community Area of Wayne County, Michigan.

[5]The City of Westland was part of the survey in 1999 and 2000, but has been removed from the figure as they did not participate in the current survey. Brownstown Township and Romulus were added in the 2001 survey, thus rates for 1999 and 2000 are not available.

DISCUSSION

The estimated belt use rate for front-outboard occupants of passenger cars, sport-utility vehicles, vans/minivans, and pickup trucks combined in the six community area of Wayne County, Michigan was 75.4 ± 3.0 percent. When compared with the rate for all of Wayne County estimated in the most recent annual statewide survey (Eby & Vivoda, 2001), we find that the rate from the current survey is 5.7 percentage points lower. At least part of this disparity results from the fact that in the present study, belt use on freeway exit ramps was not observed. Across Michigan, freeway belt use is usually one or two percentage points higher than for local intersections (see, e.g., Eby, Molnar, & Olk, 2000; Eby, Vivoda, & Fordyce, in press), however in the most recent statewide survey, belt use was more than five percentage points higher for freeway traffic (Eby & Vivoda, 2001). Thus, the present survey more accurately reflects front-outboard safety belt use on local roads.

While changes in the communities participating in the survey make overall comparisons between the current survey and the surveys conducted in 1999 and 2000 difficult, we find that the rate from this survey is about the same as the one observed in 2000 (Eby, Fordyce, & Vivoda, 2000). However, a comparison with the observed rate from September 1999 reveals an increase of nearly 21 percentage points (Eby, Vivoda, & Fordyce, 1999). This significant increase can most likely be jointly attributed to the implementation of standard enforcement legislation in Michigan on March 10, 2000, extensive Public Information and Education (PI&E) programs, and multiple enforcement campaigns that have been implemented in Wayne County.

An examination of safety belt use patterns in the current survey showed many trends that are often observed in Michigan (Eby, Molnar, & Olk, 2000; Eby, Vivoda, & Fordyce, in press). The survey showed that the belt use rate for drivers continues to be higher than for passengers. However, in the two studies conducted since the change to standard enforcement, this difference appears to have decreased somewhat. The motorists that still remain unbelted in either seating position are likely to be the most difficult to reach. Further research is essential to better understand the dynamics of

passenger belt use in order to develop appropriate and effective PI&E programs. Of particular interest would be a study to determine the age difference and relationship between the driver and passenger to determine which combinations are at a higher risk for safety belt nonuse. For example, front-outboard passengers may be less likely to use safety belts if they are a friend of the driver rather than a family member. Such information would be invaluable for constructing effective PI&E programs to promote safety belt use.

Belt use was also higher for females than for males. Again, this finding is consistent with years of safety belt research both in Michigan (Eby, Molnar, & Olk, 2000; Eby, Vivoda, & Fordyce, in press) and elsewhere (e.g., Lange & Voas, 1998; Williams, Wells, & Lund, 1987). However, the difference between the two sexes appears to have decreased somewhat over the last year. Male belt use has slightly increased while female belt use has slightly decreased, since the study conducted in September of 2000. Further analysis reveals that the majority of this change occurred within the 30-to-59-year-old age group. Females in this age group showed a 5 percentage point decrease, while male belt use in the 30-to-59-year-old age group increased by 5 percentage points. There is no obvious explanation for this change, as belt use in this age group has historically been quite stable (see, e.g., Eby, Molnar, & Olk, 2000; Eby, Vivoda, & Fordyce, in press). Even with the observed change in belt use by sex in this survey, female belt use was still higher than male belt use in all age groups. This finding highlights the need for traffic safety professionals to continue to explore efforts to increase belt use in the male population. However, females should not be ignored in these efforts, as their safety belt use rate appears to have declined somewhat, and does not reflect total compliance with Michigan's safety belt use law.

The present study also examined safety belt use by time of day and found that belt use was highest during the morning rush hour and declined towards the end of the day. This finding adds to the growing evidence that safety belt use in Michigan is typically higher in the morning (before 1:00 pm) than in the afternoon (see Eby & Olk, 1998; Eby & Vivoda, 2001). Since morning driving is frequently related to commuting to work, this result suggests that the decision to use a safety belt may be related to the trip purpose. Research directed toward understanding the relationship between frequency of belt use

and purpose of automobile trip could yield valuable information for developing more effective belt promotion programs.

Analysis of belt use by age group showed the pattern consistently observed in Michigan. When the two youngest age groups are excluded because of low representation in the sample, safety belt use for the 16-to-29-year-old age group was the lowest of any age group. NHTSA has recognized that current traffic safety messages for this age group may not be cognitively appropriate and has begun an effort to better understand the factors that influence decision making in young drivers (see, e.g., Eby & Molnar, 1999). This information can lead to the development of cognitively appropriate traffic safety messages to increase safety belt use among this age group.

While the Community Survey provides an overall safety belt use rate for the six community area of Wayne County, Michigan, it does not provide individual community rates that can be generalized to the entire city or township. However, rates are provided for each individual community to allow for comparisons of belt use over time in each specific area. Specifically, these rates can be used to measure changes in safety belt use that may result from a particular PI&E program or enforcement campaign in each specific city or township. An analysis of these rates appear to show a slight decline in the cities of Detroit and Taylor over the last year, however these rates are not statistically different than the rates from 2000. There also appear to be slight increases in belt use in the cities of Dearborn and Livonia, but again, these differences are not statistically significant. Belt use was highest in the two communities that were added to the current survey, Brownstown Township and Romulus. These rates were significantly higher than the rates in both Detroit and Taylor. Differences in belt use rates between communities can be due to many different factors and should be interpreted with caution since this survey was not designed to report individual community-wide belt use rates.

This study enables us to measure safety belt use rates in the six community area of Wayne County, Michigan. It also allows us to identify emerging trends, to examine and measure changes resulting from standard enforcement legislation, and to assess the effects of PI&E programs in this area. The findings of this study can be considered

superior to the findings of the statewide survey since this study focuses entirely on local traffic. Collectively, the findings of this study suggest that legislation, enforcement, and PI&E programs by the Michigan Office of Highway Safety Planning, and other local programs, have been effective in increasing belt use in the six community area of Wayne County.

The current study also reports safety belt use rates separated into several demographic categories. These categorical belt use rates suggest that PI&E programs targeted at specific groups within the Wayne County area could be of a particular benefit, especially programs aimed at passengers, males, and 16-to-29 years olds. Safety belt use increases can be maximized in Wayne County by targeting programs toward those populations most likely to benefit. Given the dramatic increases in belt use that were observed after the implementation of standard enforcement, these specifically targeted programs are more important than ever to maintain and continue to increase belt use, especially in an area that has historically had low belt use such as Wayne County. To make these programs most effective, further research is necessary to develop PI&E programs and messages to appeal to the diverse cultural groups and communities represented in the Wayne County area.

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APPENDIX A

Data Collection Forms

SITE DESCRIPTION 2001

SITE # ___ (1 2 3) SITE LOCATION _____

SITE TYPE (4)
1☐ Intersection
2☐ Freeway

Exit No. _____

SITE CHOICE (5)
1☐ Primary
2☐ Alternate

TRAFFIC CONTROL (6)
1☐ Traffic Light
2☐ Stop sign
3☐ None
4☐ Other _____

DATE (month/day): __/__/2001 (7 8 9 10)

OBSERVER (11)
1☐ Steve
2☐
3☐
4☐ Jane
5☐ Jonathon
6☐ Linda
7☐ Dave

DAY OF WEEK (12)
1☐ Monday
2☐ Tuesday
3☐ Wednesday
4☐ Thursday
5☐ Friday
6☐ Saturday
7☐ Sunday

WEATHER (13)
1☐ Mostly Sunny
2☐ Mostly Cloudy
3☐ Rain
4☐ Snow

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

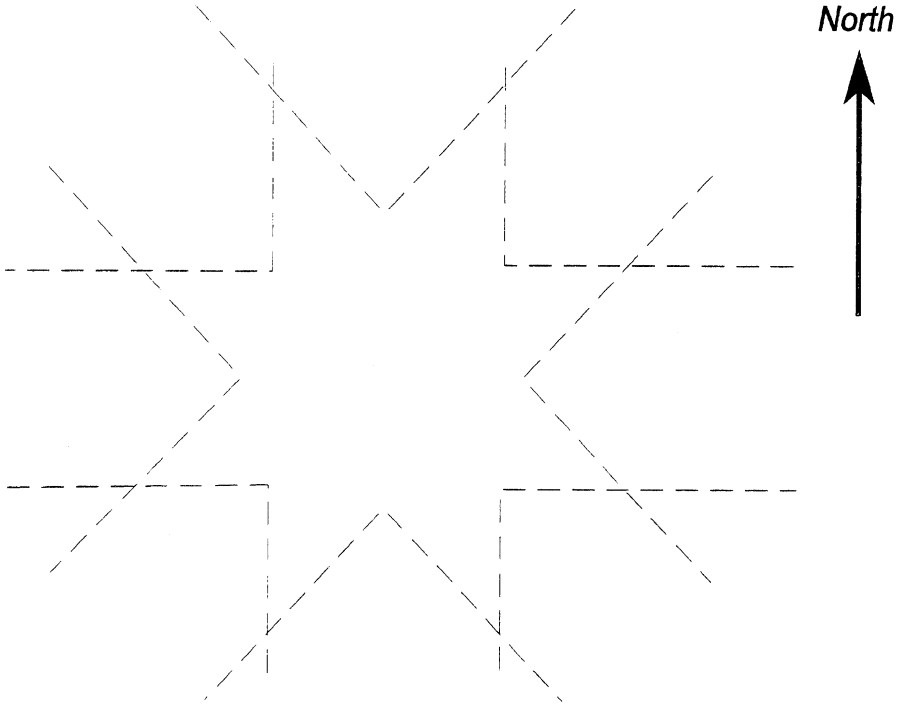
INTERRUPTION (total number of minutes during observation period): ___ (22 23)

MEDIAN: (24)
1☐ Yes
2☐ No

TRAFFIC COUNT 1: ___ (25 26 27)

TRAFFIC COUNT 2: ___ (28 29 30)

COMMENTS::



SITE # ___ ___ ___ (1 2 3) PAGE #________

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

Survey Sites by Number

Site #	City	Site Location
401	Livonia	SB Stamford & 5 Mile Rd.
402	Detroit	NWB Morrell & Fort St.
403	Taylor	WB Goldenridge Ave. & Pardee Rd.
404	Dearborn	NWB Greenfield Rd. & S. Commerce Dr.
405	Livonia	NB Blueskies & 5 Mile Rd.
406	Detroit	NB Hoover & State Fair
407	Livonia	SB Lyons Ave. & Jamison
408	Livonia	SB Louise Ave. & Bobrich
409	Detroit	SB Mark Twain St. & McNichols
410	Detroit	SWB Edward Ave. & Martin St.
411	Livonia	WB Puritan Ave. & Henry Ruff
412	Detroit	NB Manor & Chicago
413	Detroit	NEB Linsdale & Epworth
414	Romulus	NB Ozga Rd. & Tyler Rd.
415	Dearborn	NB N. York St. & Doxtator Rd.
416	Detroit	SB Trinity Ave. & Lyndon
417	Romulus	EB Huron River Dr./Grant Rd. & Ozga Rd.
418	Detroit	NWB Frontenac St. & Edsel Ford Rd/I-94 Service Dr.
419	Romulus	SB Merriman Rd. & Ecorse Rd.
420	Livonia	WB Richland Ave. & Stark Rd.
421	Detroit	NEB Rosemary & Roseberry
422	Detroit	SEB Elmwood & Charlevoix
423	Livonia	NB Wood Dr. & Fairlane
424	Detroit	SEB St. Jean & Kercheval Ave.
425	Romulus	WB Ecorse Rd. & Hannan Rd.
426	Detroit	EB Mogul St. & Hayes
427	Romulus	NB Middlebelt Rd. & Eureka Rd.
428	Livonia	NB Victor Park Dr. & 8 Mile Rd.
429	Taylor	WB Pinecrest & Pelham
430	Detroit	SB Winston & Grand River Ave.
431	Dearborn	NEB Dix & Vernor Hwy.

432	Detroit	WB Woodlawn Ave. & Erwin
433	Dearborn	WB Longmeadow & Brewster
434	Detroit	SB Waterman St. & South
435	Taylor	WB Eureka Rd. & Inkster Rd.
436	Taylor	NB Cape Cod St. & Goddard Rd.
437	Brownstown Township	WB Van Horn & US-24/Telegraph Rd.
438	Brownstown Township	SB Arsenal & Van Horn
439	Brownstown Township	EB West Rd. & US-24/Telegraph Rd.
440	Brownstown Township	SB US-24/Telegraph Rd. & Sibley
441	Brownstown Township	NB Allen Rd. & Sibley

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:

$$var \approx \frac{n}{n-1}\sum_i \left(\frac{g_i}{\Sigma g_k}\right)^2 (r_i - r)^2 + \frac{n}{N}\sum_i \left(\frac{g_i}{\Sigma g_k}\right)^2 \frac{s_i^2}{g_i}$$

where *var* equals the variance, 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 at all 36 sites, r_i is the weighted belt use rate at intersection I, r is the belt use rate, N is the total number of intersections, and $s_i = r_i(1-r_i)$. In the actual calculation of the variance, the second term of this equation is negligible. If we conservatively estimate N to be 2000, the second term only adds 2.1×10^{-6} units. 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 95 percent confidence bands were calculated using the formula:

$$95\%\ Confidence\ Band = r \pm 1.96 \times \sqrt{Variance}$$

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

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

$$RelativeError = \frac{StandardError}{r}$$