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16. Abstract

Reported here are the results of a direct observation survey of safety belt use in a five city area of Wayne County, Michigan, conducted in the fall of 1999. The five cities included in the survey area were: Dearborn, Detroit, Livonia, taylor, and Westland. In this study, 1,083 occupants traveling in four vehicle types (passenger cars, sport-utility vehicles, vans/minivans, and pickup trucks) were surveyed during September 18 to September 23, 1999. 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 54.5 percent. Belt use was 55.8 percent for passenger cars, 57.6 percent for sport-utility vehicles, 55.4 percent for vans/minivans, and 44.2 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 provide a baseline from which to measure safety belt use trends in the five cities over the next year and beyond. The study is superior to the statewide survey for assessing the effects of local programs in the five cities since it focuses entirely on local traffic.

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November, 1999

INTRODUCTION

Of Michigan's 83 counties, Wayne County represents close to 23 percent of the state's total population (US Bureau of the Census, 1990) and 17 percent of Michigan's total vehicle miles of travel (VMT). The population density accounts for part of the disproportionately high VMT (15.29 billion); other contributing factors include the I-75 corridor, and the large numbers of nonresidents who travel through the county, as well as the high concentration of arenas, convention centers, businesses, and industry in this area (Michigan Office of Highway Safety Planning, OHSP, 1999).

This relatively high VMT level is accompanied by an increased likelihood of automobile crashes. Wayne County accounted for 22 percent of 425,793 reported traffic crashes in Michigan in 1997. Between 1993 and 1997, there were 64,853 crash-related injuries, the highest of any county in the state. The total cost of motor vehicle crashes has been estimated at $9,707,518,300 (OHSP, 1998). Given the fact that Wayne County makes up such a significant proportion of these crashes, the estimated loss to this community is very high.

In these automobile crashes, safety belt use was directly related to the level of injury sustained. Occupants in automobile crashes were twenty-five times more likely to be killed if they were not wearing safety belts (OHSP, 1998). Wayne County has one of the lowest safety belt use rates in the state, leading to a higher number of automobile-related injuries and fatalities.

In an effort to increase safety belt use nationally, the President of the United States (US) directed the Secretary of Transportation to work with several groups including Congress, the states, and private enterprise to develop a plan for increasing safety belt use in the US. This plan, called the *Presidential Initiative for Increasing Seat Belt Use Nationwide*, sets national safety belt use rate goals and details a national strategy for achieving these goals (National Highway Traffic Safety Administration, NHTSA, 1997).

The first goal of this initiative is to increase seat belt use nationally to 85 percent by the year 2000 and 90 percent by 2005. NHTSA (1997) estimates that this increase in safety belt use by 2000 will prevent about 4,200 fatalities and 102,500 injuries, and result in economic savings of about 6.7 billion dollars annually. The second goal is to reduce child occupant fatalities (0-to-4 years of age) by 15 percent by 2000 and 25 percent by 2005.

For years, Michigan has implemented enforcement and public information and education (PI&E) programs to increase safety belt use statewide. While these programs have been effective in increasing safety belt use rates, more specific programs are necessary to meet the needs of Wayne County's diverse population. To be most effective, these PI&E programs must be tailored to the specific regional and ethnic communities of Wayne County. The safety belt use rate for Wayne County remains several percentage points below the average for Michigan (Eby, Vivoda, & Fordyce, 1999). In order for Michigan to reach the national goals set for the years 2000 and 2005, it is necessary to significantly increase the safety belt use rate in Wayne County.

These goals can be accomplished, but additional funds will be necessary. While Michigan has devoted concerted effort to increasing belt use in Wayne County over the last several years, it has become apparent that additional, community-based programs may have the greatest potential for reaching segments of the population that disregard safety belt use. Fortunately, this year Michigan applied for and was awarded Section 157 innovative grant funding from NHTSA. With these additional funds Michigan will concentrate on programs designed to increase safety belt use in the diverse populations of Wayne County.

This study provides baseline data for both assisting in the development of appropriate safety belt promotion programs in five cities located in Wayne County, Michigan and for comparing changes in safety belt use within the county over the next year and beyond. Unlike the statewide survey, the design of this survey focuses exclusively upon belt use on local roads in five Wayne County communities: Dearborn, Detroit, Livonia, Taylor, and Westland. Thus, the survey provides baseline data to more 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 the modifications noted.

The purpose of the study was to assess the safety belt use rate in a five-city area in Wayne county. This area consisted of the following cities: Dearborn, Detroit, Livonia, Westland, and Taylor. Because cities were sampled collectively, individual safety belt use rates calculated for each city may not be representative of a city's belt use rate. Separate city safety belt use rates are presented only as a way of tracking the effectivness of belt use programs in each of the five cities.

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 five cities. To begin, detailed equal-scaled road maps of the Detroit Metropolitan Area were obtained. The five cities 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.

The 36 sites in the survey were chosen sequentially, by first randomly selecting a map number containing one of the cities in the sample[1]. 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

[1]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 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 five cities. This process was repeated until an eligible intersection was identified. Site numbers were assigned in numerical order, following this same process, until 36 sites had been selected.

Once all of the sites were selected, the street and direction of traffic flow to be observed was chosen. 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 then assigned as the street to be observed. In a similar manner, if it was not possible to observe the traffic flow in the direction that had been chosen during site selection, the opposite direction was assigned as the direction to be observed. For example, if northbound Second Street was to be observed, and Second Street was a one-way street with traffic flowing south only, 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 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, 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 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 about the 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 36 observation sites. As shown in this table, the observations were fairly well distributed over time of day 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, then it was included in the later time slot. This table also shows that nearly every site observed was the primary site and most observations occurred on sunny or cloudy days.

Table 1. Descriptive Statistics for the 36 Observation Sites

Day of Week		Observation Period		Site Choice		Weather	
Monday	27.8%	7-9 a.m.	8.3%	Primary	97.2%	Sunny	61.1%
Tuesday	19.4%	9-11 a.m.	27.8%	Alternate	2.8%	Cloudy	30.6%
Wednesday	11.1%	11-1 p.m.	22.2%			Rain	8.3%
Thursday	19.5%	1-3 p.m.	27.8%			Snow	0.0%
Friday	0.0%	3-5 p.m.	13.9%				
Saturday	11.1%	5-7 p.m.	0.0%				
Sunday	11.1%						
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 September 18 through September 23, 1999. Safety belt use, age, sex, and vehicle type observations were conducted when a vehicle came to a stop at a traffic light or a stop sign. It was also noted whether or not the vehicle was used for commercial purposes.

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 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.

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 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-right passenger present. In addition to this information, it was also recorded whether or not the vehicle was used for commercial purposes. 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

All sites in the sample were visited by single observers for a period of 1 hour, with the exception of sites in the city of Detroit, and sites in other cities 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 arriving at a site, observers determined whether observations were possible at the site. 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 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 single-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. Also included in the manual was a listing of the sites for the study that identified the location of each site and the traffic leg to be observed (see Appendix B for a listing of the sites), as well as a site schedule identifying the date and time each site was to be observed.

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 lanes 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. 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 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 three 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 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 and data collection 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 in this safety belt survey was to estimate belt use for the five city area in Wayne County, Michigan based on 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.[2] 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 then was divided by the actual vehicle count for each vehicle type to obtain a VMT weighting factor for that site and vehicle type. This weighting factor was multiplied by the actual vehicle counts at the site, yielding a weighted N for the number of total drivers and passengers and total number of belted drivers and belted 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 five city 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:

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

The totals are the sums across all 36 sites after weighting, and occupants refers to only 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.

[2] 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.

RESULTS

Overall Safety Belt Use

As shown in Figure 1, 54.5 percent ± 6.2 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 five city area of Wayne County, Michigan during September 1999 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 48.3 percent and 60.7 percent.

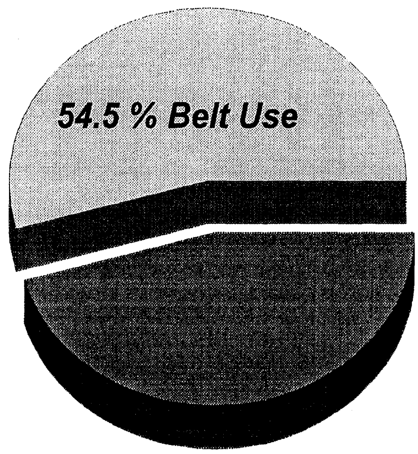

Figure 1. Front-Outboard Shoulder Belt Use in a Five City Area of Wayne County, Michigan (All Vehicle Types and Commercial/Noncommercial Combined).

Table 2 shows the shoulder belt use rates and unweighted number of occupants by vehicle type in the five city area of Wayne County, Michigan. Note that the unweighted number of occupants is fairly low for all vehicle types except for passenger vehicles. Thus, it is not possible to calculate meaningful individual safety belt use rates by vehicle type for any subcategories. 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 Five City Area of Wayne County, Michigan		
Vehicle Type	**Percent Use**	**Unweighted N**
Passenger	55.8 ± 6.8 %	726
Van/Minivan	55.4 ± 15.8 %	146
Sport Utility	57.6 ± 5.9 %	82
Pickup Truck	44.2 ± 8.8 %	129
All Vehicles Combined	**54.5 ± 6.2 %**	1,083

Estimated Safety Belt Use by Seating Position

Estimated safety belt use rates by seating position is shown in Figure 2. As is typically found in Michigan (Eby, Molnar, & Olk, in press; Eby, Vivoda, & Fordyce, 1999), driver belt use was significantly higher than passenger belt use.

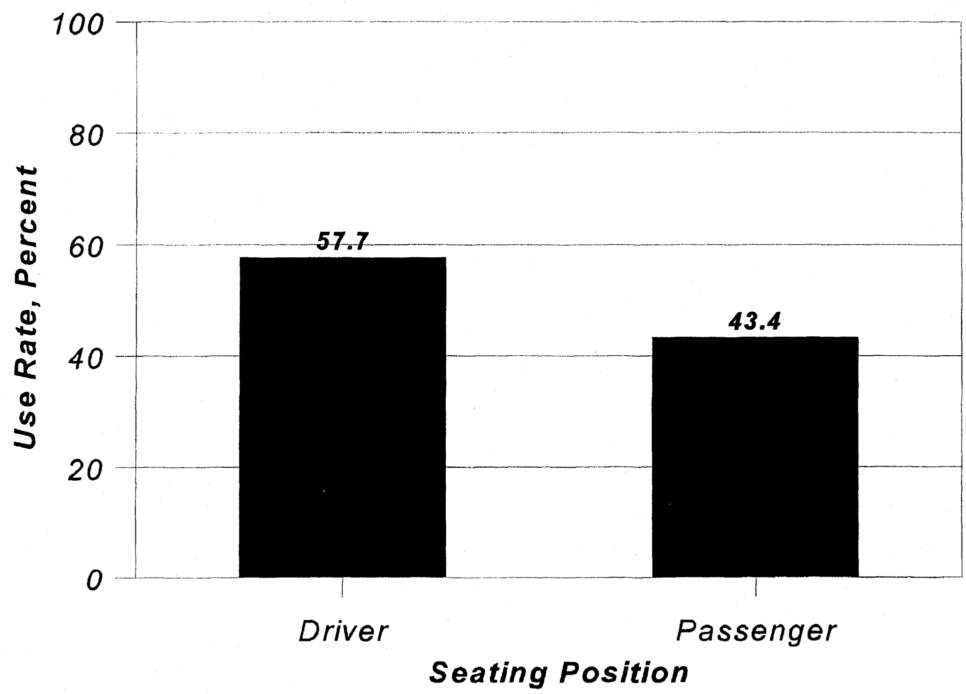

Figure 2. Front-Outboard Shoulder Belt Use by Seating Position in the Five City Area of Wayne County, Michigan (All Vehicle Types and Commercial/Noncommercial Combined).

Estimated Safety Belt Use by Sex

The estimated safety belt use rates by sex for the five city area of Wayne County, Michigan is shown in Figure 3. Female belt use is clearly higher than male belt use, consistent with a large body of research on safety belt use by sex (see Eby, Molnar, & Olk, in press, for a review).

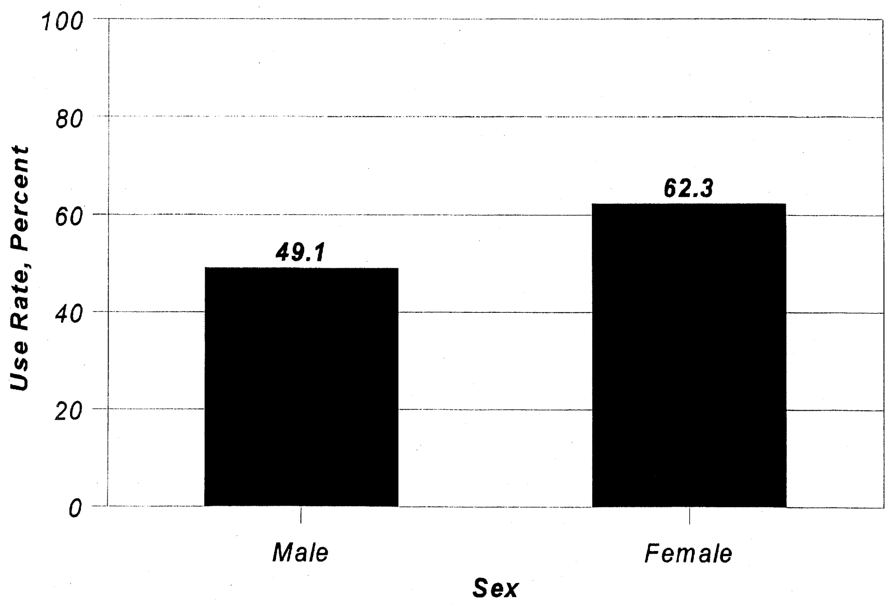

Figure 3. Front-Outboard Shoulder Belt Use by Sex in the Five City Area of Wayne County, Michigan (All Vehicle Types and Commercial/Noncommercial Combined).

Estimated Safety Belt Use by Time of Day

The estimated safety belt use rates in the five city area of Wayne County, Michigan by time of day is shown in Figure 4. Safety belt use was highest during the morning rush hour and steadily declined during the day. Unfortunately, the random assignment of times for data collection did not yield safety belt observation times after 5 pm. Thus, we cannot determine whether safety belt use increased, decreased, or stayed the same during the evening rush hour.

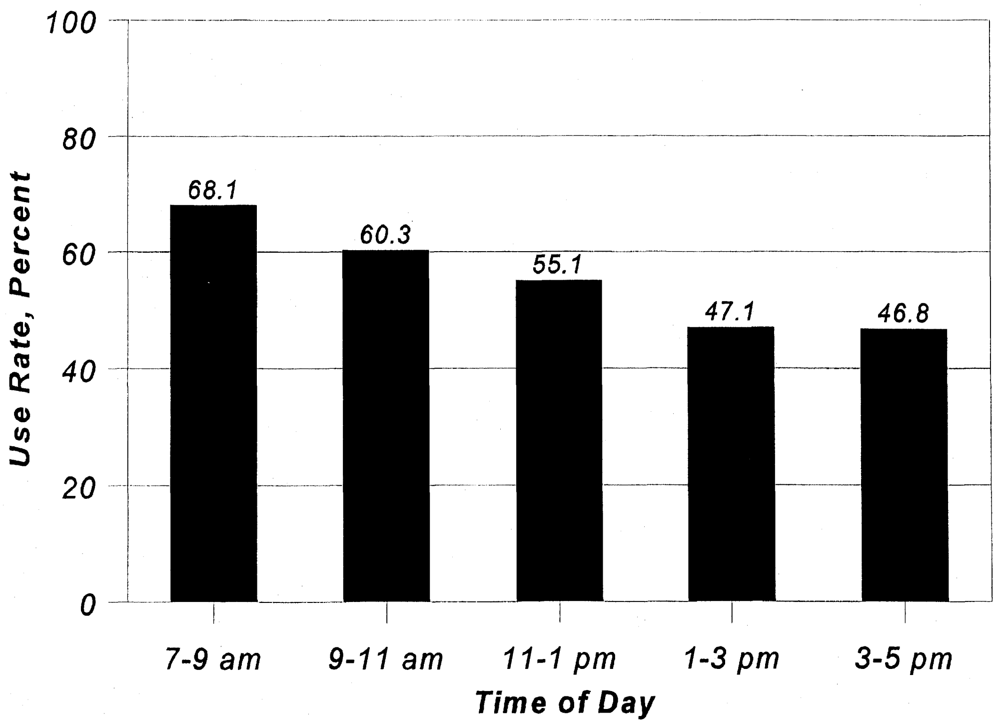

Figure 4. Front-Outboard Shoulder Belt Use by Time of Day in the Five City Area of Wayne County, Michigan (All Vehicle Types and Commercial/Noncommercial Combined).

Estimated Safety Belt Use by Age

Estimated safety belt use rates by age is 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. There were also only 37 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 great caution. Excluding these age groups, we find that belt use is lowest for the 16-to-29-year olds and steadily increases with age. This is the same trend found in the recent statewide survey of safety belt use (Eby, Vivoda, & Fordyce, 1999).

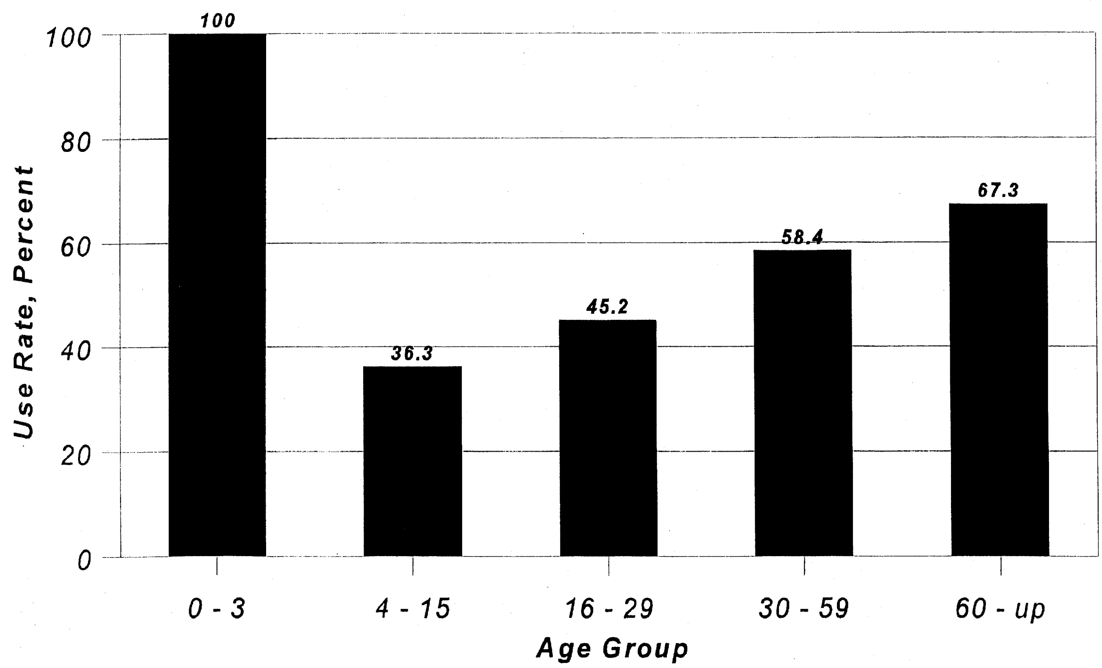

Figure 5. Front-Outboard Shoulder Belt Use by Age Group in the Five City Area of Wayne County, Michigan (All Vehicle Types and Commercial/Noncommercial Combined).

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. Excluding these age groups, we find that male belt use is considerably less than the rates for females for all age groups and that the use rates increase with age for both sexes.

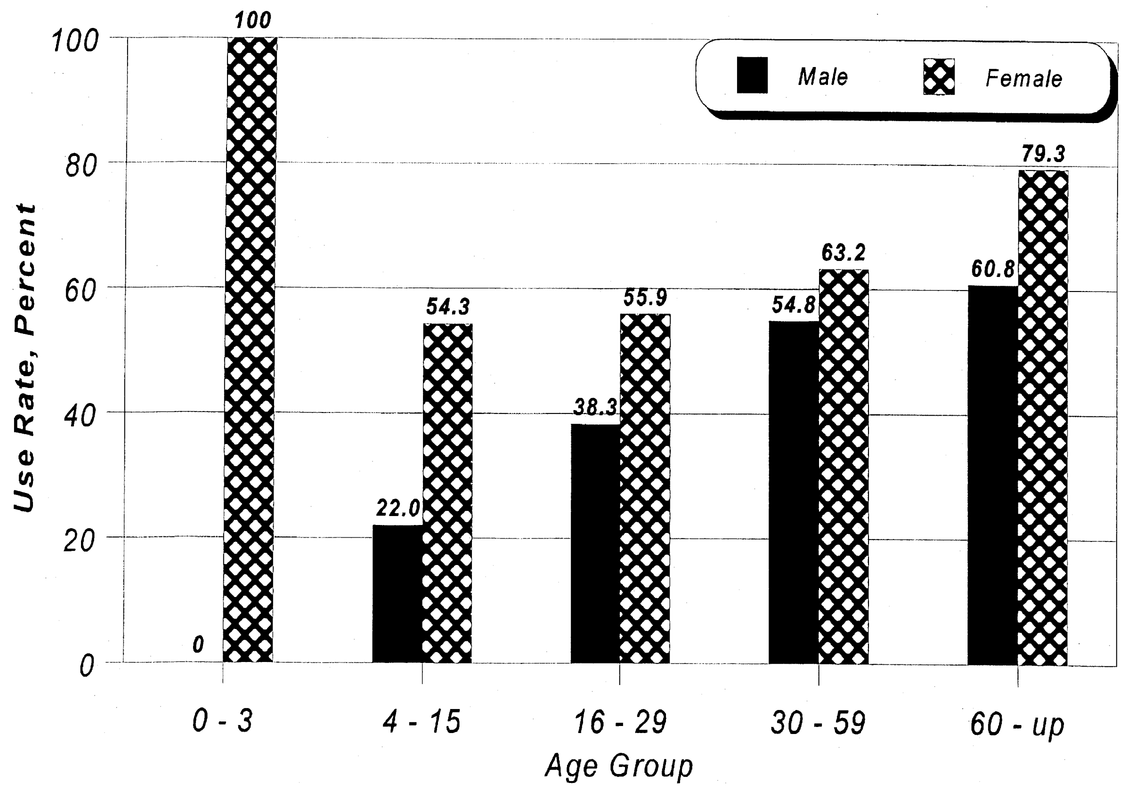

Figure 6. Front-Outboard Shoulder Belt Use by Age and Sex in the Five City Area of Wayne County, Michigan (All Vehicle Types and Commercial/Noncommercial Combined).

Estimated Safety Belt Use by City

So that the effects of safety belt use programs that are specific to a city can be measured, we have calculated safety belt use over all vehicle type for each city separately. It should be noted that the sample was designed for determining safety belt use across the five-city area. Therefore, the city-by-city numbers reported here may not representative of citywide belt use. Table 3 shows the safety belt use rates and unweighted numbers of people observed by city. The cities of Detroit and Taylor had the lowest belt use rates of the five cities.

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

City	Percent Use	Unweighted N
Dearborn	63.4 ± 8.5 %	118
Detroit	43.8 ± 4.4 %	501
Livonia	65.3 ± 8.2 %	148
Taylor	53.9 ± 1.0 %	179
Westland	69.6 ± 1.7%	137

DISCUSSION

The estimated belt use rate for front-outboard occupants of passenger cars, sport-utility vehicles, vans/minivans, and pickup trucks combined in the five city area of Wayne County, Michigan was 54.5 ± 6.2 percent. When compared with this year's rate for all of Wayne County estimated in the annual statewide survey (Eby, Vivoda, & Fordyce, 1999), we find that the rate from the current survey is about ten percentage points lower. At least part of this disparity results from the fact that in the current survey belt use on freeway exit ramps was not observed. While belt use on freeways across Michigan is usually one or two percentage points higher than for local intersections (see Eby, Vivoda, & Fordyce, 1999), an analysis of this year's statewide survey in Wayne County showed that freeway belt use is about five percentage points higher than belt use on local roads. Thus, the present survey in the five city area of Wayne County more accurately reflects front-outboard safety belt use on local roads.

Belt use by the various subcategories showed the trends that are familiar in Michigan (Eby, Molnar, & Olk, in press; Eby, Vivoda, & Fordyce, 1999). The analysis of safety belt use by vehicle type showed that occupants in passenger cars, sport-utility vehicles, and vans/minivans used safety belts at approximately the same rates. Unfortunately, the use rate for pickup truck occupants was considerably lower. This drastic and consistent difference between other vehicle types and pickup trucks (see Eby, Vivoda, & Fordyce, 1999) suggest that occupants of pickup trucks may define a unique population in Michigan and elsewhere. If so, this unique population may benefit from specially designed programs.

Who are the occupants of pickup trucks? This question has been partially answered in a recent study in Riverside, California (Anderson, Winn, & Agran, 1999). In this study a random sample of households were surveyed. Pickup truck drivers/owners were compared to passenger car driver/owners on demographics, self-reported risky driving, self-reported driving history, and attitudes toward traffic safety laws. The study revealed that the main demographic differences were that pickup truck driver/owners were more often male and 30-to-39 years of age. When the results were adjusted for sex and age, pickup truck drivers/owners had higher household incomes, lower educational levels, and were more likely to be married and have preteen children. Again when age and sex were adjusted between the two groups, there were no differences in self-reported driving history, attitudes toward traffic safety laws, or self-reported risky driving behaviors except that pickup truck drivers/owners more frequently drank beverages (not necessarily alcoholic) while driving. Whether these results can be generalized to resident of Wayne County, Michigan is unknown. However, the results provide a starting point for the development of programs designed to influence pickup truck occupant safety belt use. Particular attention should be paid to the findings that pickup truck driver/owners tend to be less educated than passenger car driver/owners but have a higher income.

The present study showed that the belt use rate for drivers was consistently higher than for passengers. Our analysis indicates that new efforts should be made to encourage passengers to use safety belts. 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 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, in press) and elsewhere (e.g., Lange & Voas, 1998; Williams, Wells, & Lund, 1987). While not surprising, this finding highlights the need for traffic safety professionals to continue to explore efforts to increase belt use for the male population.

The present study examined belt use by time of day and found that belt use was highest during the morning rush hour and declined steadily throughout the day. The findings 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, &

Fordyce, 1999). Since morning driving is frequently related to business commuting, this result suggests that the decision to use a safety belt may be related to the trip purpose. Research directed at understanding the relationship between frequency of belt use and purpose of automobile trip could yield valuable facts for developing more effective belt promotion programs.

Analysis of belt use by age group showed the familiar pattern. 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. Considering safety belt use by both age and sex showed that males had consistently lower belt use than females and that use by both increased with age. Thus, the effect of sex on belt use in the five city area of Wayne County, Michigan does not seem to be age related.

Collectively, these findings provide a baseline from which to measure safety belt use trends in the five city area of Wayne County, Michigan over the next year and beyond. The study is superior to the statewide survey since it focuses entirely on local traffic.

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APPENDIX A

Data Collection Forms

SITE DESCRIPTION 1999

SITE # ___ ___ ___ (1 2 3)   SITE LOCATION ______________________________

SITE TYPE
1☐ Intersection
2☐ Freeway
4
Exit No. ________

SITE CHOICE
1☐ Primary
2☐ Alternate
5

TRAFFIC CONTROL
1☐ Traffic Light
2☐ Stop sign
3☐ None
4☐ Other ______________
6

DATE (month/day): ___ ___/___ ___/1999 (7 8 9 10)

OBSERVER
1☐ Shumit
2☐ Steve
3☐ John
4☐ Jim
5☐ Jonathon
6☐ Tiffani
7☐ Dave
11

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

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

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

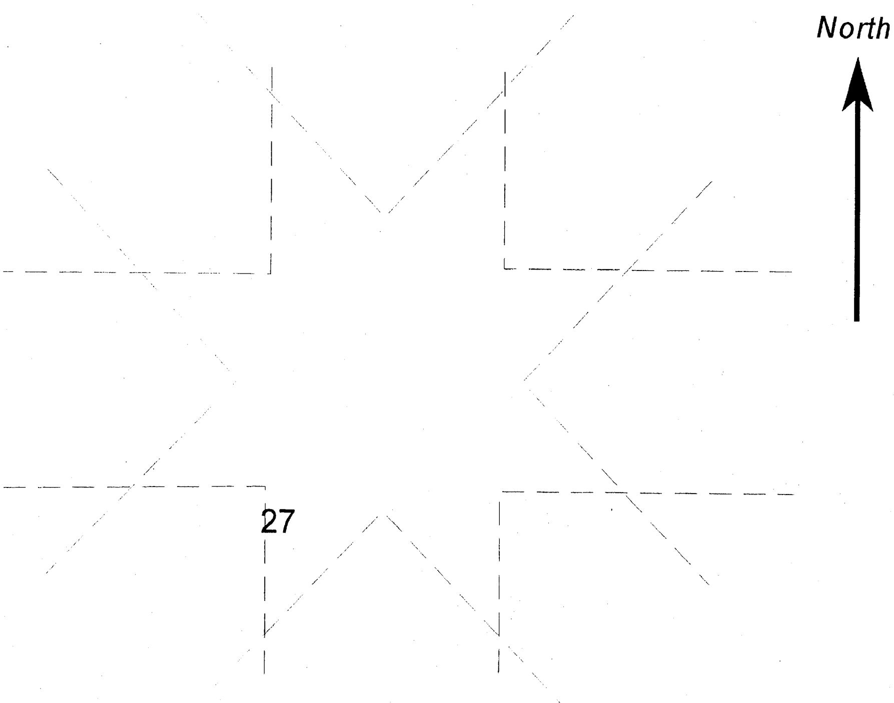
INTERRUPTION (total number of minutes during observation period): ___ ___ (22 23)

MEDIAN: 1☐ Yes
2☐ No
24

TRAFFIC COUNT 1: ___ ___ ___ (25 26 27)

TRAFFIC COUNT 2: ___ ___ ___ (28 29 30)

COMMENTS:



SITE # ___ ___ ___
1 2 3

PAGE #________

ATTENTION CODING: DUPLICATE COL 1 - 3 FOR ALL VEHICLES **1999**

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. & Oakley
408	Livonia	SB Louise Ave. & 6 Mile
409	Detroit	SB Mark Twain St. & McNichols
410	Detroit	SWB Edward Ave. & Martin St.
411	Livonia	WB Puritan Ave. & Merriman
412	Detroit	WB Orangelawn Ave. & Schaefer Hwy.
413	Detroit	NEB Linsdale & Epworth
414	Westland	WB Hunter Ave. & Farmington
415	Dearborn	NB N. York St. & Ford Rd.
416	Detroit	SB Trinity Ave. & Lyndon
417	Westland	NB Farmington Rd. & Cherry Hill Rd.
418	Detroit	SEB Frontenac St. & E. Grand Blvd.
419	Westland	SB Newburgh & Marquette
420	Livonia	WB Richland Ave. & Stark Rd.
421	Detroit	NEB Rosemary & Roseberry
422	Detroit	SEB Elmwood & Vernor Hwy.
423	Livonia	WB Wood Dr. & Fairlane
424	Detroit	SEB St. Jean & Charlevoix
425	Westland	WB Bock Rd. & Wayne Rd.
426	Detroit	EB Mogul Ave. & Hayes
427	Westland	SB Surrey Heights & Avondale
428	Livonia	NB Victor Parkway Dr. & 8 Mile Rd.
429	Taylor	EB Pinecrest & Pelham
430	Detroit	SB Winston & Grand River Ave.
431	Dearborn	NEB Dix & Vernor Hwy.
432	Detroit	WB Woodlawn Ave. & VanDyke Ave.
433	Dearborn	WB Longmeadow & Brewster
434	Detroit	SB Waterman St. & Jefferson Ave.
435	Taylor	WB Eureka Rd. & Inkster Rd.
436	Taylor	NB Cape Cod St. & Goddard Rd.

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:

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

In the present survey, the relative error was 5.8 percent.