OHIO DEPARTMENT OF PUBLIC SAFETY
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Observational Survey of Seat Belt Use in Ohio 2017

Prepared for:
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The Ohio Traffic Safety Office
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2017

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The Ohio Department of Public Safety Office and its Ohio Traffic Safety Office administration and the Applied Research Center's Director and staff are grateful to retired officers of the Ohio State Highway Patrol for their excellent field observation research.

This research endeavor is derived from a design that conforms to the requirements of the Uniform Criteria and was developed in consultation with and approved for Ohio under an agreement with the Statistical Consulting Center at Miami University. John Bailer, Chair and Distinguished Professor at Miami University, and Doug Noe, Associate Professor, provided additional statistical support through data analysis. We are grateful to the entire Statistical Consulting Center staff, which additionally includes Michael Hughes, Manager, and Dr. Jing Zhang, Assistant Professor, for their insights and support.

Robert L. Seufert
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EXECUTIVE SUMMARY

Overview: The 2017 baseline *Click It or Ticket* observation survey of seat belt use in Ohio contained 20,712 vehicle occupants – 17,240 drivers and 3,472 passengers. After the *Click It or Ticket* media campaign and enforcement initiatives, another random sample of 23,193 occupants was observed at the same sites with 18,601 drivers and 4,592 passengers. Results of the second survey indicate that Ohio's 2017 weighted seat belt use rate is **82.8%**, within the margin of error of 2016's rate of 83.8%. Consequently, the 2017 survey results, with an overall margin of error of ± 1.0%, were derived from the second observational survey conducted in June after the combined *Click It or Ticket* media campaign and enforcement initiatives had been fully implemented. The 82.8% seat belt use rate for Ohio was formally reported to the National Highway Traffic Safety Administration (NHTSA).

In consultation with the Applied Research Center, retired officers of the Ohio State Highway Patrol (OSHP) conducted observation surveys of seat belt use at 233 randomly selected sites in 57 of Ohio's 88 counties. The surveys were conducted on randomly selected days of the week and times of day and included occupants of passenger cars, vans and minivans, sport utility vehicles (SUVs), and light and heavy trucks. Additional findings, which remain generally consistent with previous surveys, include the following:

- The seat belt use rate of light truck (mostly pickup truck) occupants (78.9%) is significantly lower than that of occupants of passenger cars (83.4%), vans (88.5%), or SUVs (85.2%).
- The Cleveland and Jackson districts have the lowest seat belt use rates, with rates of 69.4% and 77.6%, respectively. The highest rates were observed in the Wilmington and Findlay districts, with rates of 91.0% and 91.6%, respectively.
- The statewide rate for drivers was 82.9%; passengers were similarly likely to buckle up, at 82.3%.
- Female vehicle occupants continue to have a significantly higher rate of seat belt use (86.7%) than male occupants (80.4%).
- For vehicle occupants between 15 and 25 years of age, the seat belt use rate was 77.6% and for occupants 26-64 the rate was 83.6%; 93.3% of occupants aged 65 or older were observed to be wearing seat belts, surpassing both younger age groups. While seat belt use rates among 15-to-25-year-olds have improved, due to the high number of traffic injuries and fatalities among this age group, continued targeted intervention is recommended.

Recommendations: Several populations with low belt use rates continue to warrant targeted interventions. Similar to previous years, those populations include:

- Occupants residing in Cleveland, Jackson, and Columbus districts
- Male occupants
- Occupants aged 15-25
- Light truck occupants

BACKGROUND

Since 1991, Ohio has conducted an annual observational survey to determine seat belt use following guidelines set by the National Highway Traffic Safety Administration (NHTSA). These guidelines have traditionally given individual states much discretion in survey design and implementation, with the stipulation that each state must generate a probability-based estimate for seat belt usage of front outboard occupants of passenger vehicles. This seat belt use estimate must have a required level of precision of less than 5% relative error and a 95% confidence coefficient. Individual states have been permitted to decide how much additional information to collect based on the resources available.

In 1998, NHTSA requested that states collect vehicle-specific information as part of the survey process. Specifically, all states were asked to collect information that would permit them to generate usage rates for occupants of four types of vehicles: passenger cars, vans/minivans, sport utility vehicles (SUVs), and pickup trucks. Since 1991, and prior to 1998, Ohio's seat belt surveys only collected data from occupants of passenger cars, minivans and SUVs, and results from each site were pooled so that observers did not record seat belt use for specific types of vehicles. Therefore, the only data available were aggregate data from each site that provided overall counts of driver and passenger seat belt use. Thus, in 1998, Ohio's survey required some modifications in the way that seat belt use data were collected in order to provide the vehicle-specific information requested by NHTSA. Also, data on license plate origins (i.e., from which state the plate was issued) have not been collected since 1999, because out-of-state vehicles were only a very small proportion of vehicles observed during previous years. In 2009 through 2011, with the exception of the addition of driver's cell phone use on the observation form, the survey methodology was identical to that used in the 2008 observation surveys. The revised methodology, implemented beginning in 2012, continues to collect the same vehicle, driver, and front-seat passenger specific data. The revised methodology is explained in greater detail in the Methodology section below.

Data were collected from vehicles stopped at randomly selected intersections and freeway off-ramps, so observers had ample opportunity to collect data from each specific vehicle observed. Traffic control devices such as traffic signals or stop signs were present at nearly all observation site locations. This method gives observers not only the opportunity to collect general seat belt use data, but to also collect demographic information pertaining to seat belt use in addition to vehicle type. Ohio and other states have found differences in seat belt use as a function of vehicle type and occupant sex, and age. Research also indicates that seat belt use varies as a function of race and ethnicity. Consequently, the race of vehicle occupants was added to the survey in 2004 and has been retained in subsequent surveys. Additionally, as noted previously, the cell phone use of the driver was added to the 2009 through 2011 surveys. Modifying the survey to collect vehicle-specific information (i.e., data on usage in various vehicle types) and demographic data vastly increases our knowledge about Ohioans who are likely to wear (or not wear) their seat belts. As previously noted, while the methodology was revised in 2012, the same types of information on vehicles, drivers, and passengers have been collected in all surveys since the revision.

Also, to provide geographical information about regional trends in seat belt use, the survey is structured to estimate seat belt use by Ohio State Highway Patrol District.

This report contains the following sections:

- **Methodology**: The methodology, approved by NHTSA, outlines the manner in which observation sites were chosen and data were collected and analyzed.
- **Results**: Descriptive results of seat belt use (e.g., percent of observations by sex, age, vehicle type, race, and OSHP district) are presented in the same manner as in past *Observational Surveys of Seat Belt Use in Ohio*.
- **Recommendations**: Recommendations are based on the data derived from the descriptive statistics and a statistical weighting and analysis.
- **References** and **Appendices:** Observation sites, forms, and other pertinent information are also included.

The following section contains a full description of the methodological procedures approved by NHTSA to estimate seat belt use.

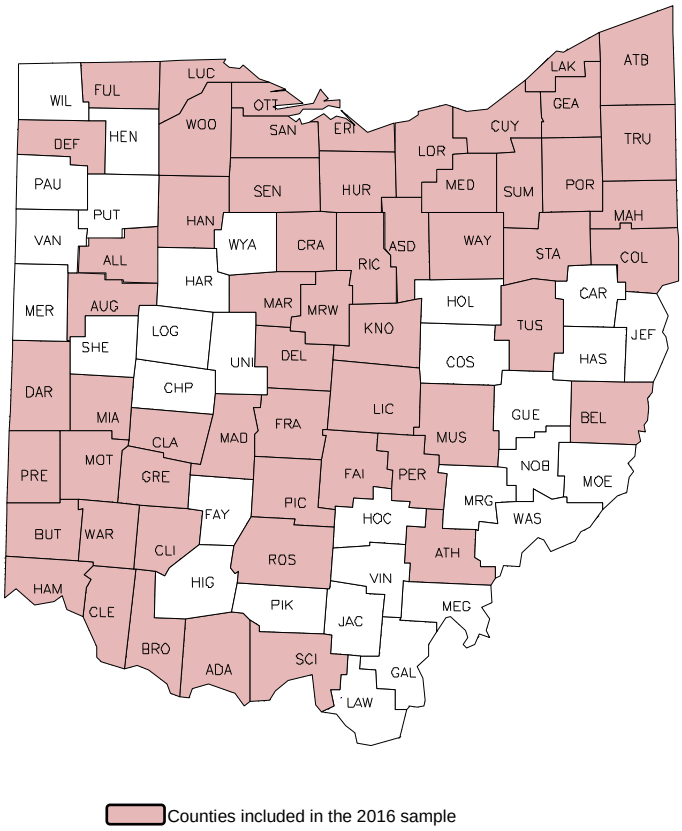
METHODOLOGY

Sample Stratification

The new methodology required a more nuanced stratification of the sample. In previous years, the sample was stratified by geographical region. Beginning in 2012, and then repeated in 2017, the sample was stratified by county and, within each county, by road type (primary, secondary, and municipal/rural). Observation sites were randomly selected road segments from each county depending on the road types available. For example, primary sites could only be selected in counties with at least one freeway off-ramp, while municipal roads could only be sampled in counties with a metropolitan statistical area (MSA). Appendix C details the breakdown of site types and numbers by county. The method of selection described later in this section was used to ensure that all intersections and off-ramps in a given county had *an equal probability of selection*. That is, all road segments, regardless of their location or traffic volumes, had equal likelihoods of selection as survey sites. In some cases, certain selected sites were impractical for observation, in which case a similar site (primary, secondary, or local) was selected to replace it.

As a preliminary measure to eliminate sites with relatively few consequences to policy implementation, counties with lower overall traffic-related fatalities were omitted from the sample. Federal guidelines permit the exclusion of low-fatality counties (cumulatively accounting for 15% or less of the state's highway fatalities) from the sample space so that the costs of sampling in these areas may be constrained. The present survey methodology excluded 31 low-fatality counties that cumulatively account for approximately 15% of the state's fatalities, reducing the sample of Ohio counties from 88 to 57 (see Figure 1 for counties). In all cases, excluded counties were rural with relatively small populations, few roads, and had relatively few crash-related fatalities.

Figure 1: Counties in 2016 Sample



Sample Size and Allocation to Strata

Observation sites within this sample of Ohio counties were randomly selected segments and freeway off-ramps, each vetted for safety and practicality via satellite imagery, street imagery, and direct observation. The ideal location was one which allowed for more detailed vehicle, driver, and occupant information to be recorded by observers while vehicles are stopped. Studies have shown that there is no discernible difference in the accuracy and reliability of seat belt use estimates obtained through stopped-vehicle direct observation (SVDO) compared to moving-vehicle direct observation (MVDO) (Eby, Streff, & Christoff, 1996). Although Ohio's survey previously employed the MVDO method, using the SVDO method whenever possible enables the collection of more detailed information without any loss in accuracy. Collected information includes vehicle type, driver and passenger belt use, sex, age, race, and driver cell phone use.

Aside from road type availability in each sampled county, the necessary number of intersection and off-ramp sites was determined based on two factors. Of primary consideration was the number of observations necessary to estimate seat belt use with 5% relative error and 95% confidence. Second, the number of sites had to be large enough to ensure a fairly equitable distribution of sites across days of the week and times of the day. The number of observations needed to estimate seat belt use at the alpha = .05 (95% confidence) level was determined. A power analysis was performed using data from Ohio's past observational surveys. Based on this analysis, a

minimum of 7,600 observations were required to estimate overall seat belt use with the desired amount of precision. See Appendix C for a breakdown of site allocation by strata (counties and road types).

Site Selection Procedures

Our research design conforms to the requirements of the Uniform Criteria and will generate annual estimates of occupant restraint use for adults and children using booster seats in the front seats of specified vehicles. We intend to update the sample of data collection sites every five years in order to have survey results for geographic areas in which more than 85% of crash-related fatalities occur. This sample design was developed in consultation with and approved for Ohio under an agreement with the Statistical Consulting Center at Miami University.

1. All 88 counties in Ohio were listed in descending order of the average number of motor vehicle crash-related fatalities for the period of 2006 to 2010. Ohio State Highway Patrol data, which are provided to the Fatal Accident Reporting System (FARS), were used to determine the 5-year average number of crash-related fatalities per county. It was determined that 57 counties accounted for approximately 86 percent of Ohio's total passenger vehicle crash-related fatalities. We selected road segments from each of the 57 counties. Thus, each county is considered a stratum when generating state or regional estimates of seat belt usage. See Appendix C.

2. It is expected that an *average* of 75 to 80 vehicles will be observed at each of 233 observation sites and approximately 17,775 to 18,960 vehicles overall based on past experience with Ohio's annual *Observational Survey of Seat Belt Use*. Estimates from previous surveys suggest the standard error will be well under the threshold of 2.5%. In the event there is a standard error greater than 2.5%, additional data will be collected from existing sites.

3. All 57 counties were stratified by road type (primary, secondary, and local/rural/city). Assuming that all three road types are present in a county, a random sample of road segments was selected from each county as follows: 2 primary segments, 2 secondary segments, and 1 local/rural/city segment, except for counties with 10,000,000 daily vehicle miles traveled (DVMT) or higher, in which case 2 local/rural/city segments were selected. As a result, 80 primary, 114 secondary, and 39 local/rural/city segments were selected overall. These sample sizes reflected a logistical constraint of available staffing for observation sites and the time to conduct the study. See Appendix C.

4. Additional stages of selection were used to determine the observation period, travel direction, lane, and vehicles to be observed, at random and with known probability, as appropriate under the Uniform Criteria.

Sample Size and Precision

A standard error of less than 2.5% on the seat belt use estimates is required by the Final Rule. Since 1999, Ohio has conducted the *Observational Survey of Seat Belt Use* and has historically reported standard errors below the 2.5% threshold. For instance, during the 2011 pre- and post-surveys, the standard error was .28% and .26% with 18,000-19,200 total observation surveys. These surveys have been obtained from previous sample designs using 48 counties and an *average* of 5 observation sites per county with an *average* of 75 to 80 observation surveys per site. Therefore, since the proposed design is expected to yield a minimum sample size of 17,775 observations across 57 counties and an *average* of approximately 4.16 segments per county, the precision objective should be achieved (i.e., 57 * 4.1578 * 75 = 17,775). In the event that the precision objective is not met, additional observations will be taken starting with sites having the fewest observations, and new data will be added to existing valid data until the desired precision is achieved. The latter step was unnecessary in the current survey.

County Selection

Of Ohio's 88 counties, 57 counties account for nearly 86 percent of all fatalities. In consultation with Statistical Consulting Center staff, we decided to include all 57 counties in the final sample of counties. For practical purposes, the Ohio State Highway Patrol (OSHP) assigns each of Ohio's counties to one of eight districts; although the sample of counties is not stratified by region in the analysis, seat belt use rates will be reported for districts as well as overall. See Appendix C.

Road Segment Selection

For each of the 57 counties, road segments were randomly selected within each county. Ohio employed the Census TIGER data for the selection of road segments. Also, Ohio exercised the available exclusion option and removed rural local roads in counties that are not within Metropolitan Statistical Areas (MSAs), and other non-public roads, unnamed roads, unpaved roads, vehicular trails, access ramps, cul-de-sacs, traffic circles, and service drives from the dataset. We stratified segments by road type and selected 2 primary segments, 2 secondary segments, and 1 local/rural/city segment from each county. When a county's DVMT was 10,000,000 or more, we selected 2 local/rural/city segments. As shown in Appendix C, primary and local segments were not always available for each county.

Appendix C contains the population of segments and number of segments sampled by county. Appendix A presents the selected road segments within each county and their probabilities of selection.

Reserve Sample

In the event that an original road segment is permanently unavailable, a reserve road segment was used. The reserve road segment sample consists of one additional road segment per original road segment selected, resulting in a reserve sample of 233 road segments. After data were sorted by segment length, road type, and county, the segment immediately following each selected segment was obtained as a backup sample, thus duplicating as closely as possible the segment characteristics of the original sample. Historically, Ohio has had great success using nearly all of the original site selections and one set of reserve sites was sufficient.

Data Collection and Observer Training

Road segments were mapped according to the latitude and longitude of their midpoints. Each selected road segment was identified by an intersection or interchange that occurred within or just beyond the segment. If no intersection or interchange occurred within the segment, then any suitable point on that road could be used for observation. Data collection sites were deterministically selected such that traffic could be observed with optimum accuracy. Therefore, whenever possible, sites were assigned to locations relatively close to controlled intersections (e.g., within 50 yards). Such locations allow for safe and accurate collection of detailed vehicle, driver, and occupant information of ongoing interest to the Ohio Department of Public Safety. Such detailed information has been historically used by Ohio to successfully plan, implement, evaluate, and adjust its interventions. For interstate highways, data collection will occur on a ramp carrying traffic that is exiting the highway. The observed direction of travel was randomly assigned for each road segment. The locations of the data collection sites were described on Site Assignment Sheets for each county and maps were developed to aid the Data Collectors and Quality Control (QC) Monitors in travelling to the assigned locations.

Training

Ohio has a crew of 18 data collectors with several years' experience observing seat belt use of front-seat vehicle occupants on its roadways. After consulting with Ohio Department of Transportation personnel, it was determined that increasing the survey coverage of counties to 57 from the historic 48 could still be managed by the current crew of observers. However, additional data collectors were hired when an observer was temporarily unable to collect data for various reasons. Also, when necessary, trained Applied Research Center personnel and Ohio Law Enforcement Liaisons from the Ohio State Highway Patrol served as QC Monitors.

Data Collector and QC Monitor training was conducted at the Ohio Department of Public Safety during the two weeks prior to the first data collection period. Data Collector and QC Monitor training included lecture, classroom, and field exercises. Previous training for Ohio observers does not differ significantly from new

stipulations in the Final Rule. The updated Ohio training manual included a list of any differences and highlighted those during the training session.

Quality control monitors mentioned above were given an additional half day training focusing on their specific duties. These duties include conducting unannounced site visits of data collectors at 5% of sites (a minimum of 12 randomly selected sites, i.e. 233 sites * .05 = 11.65 sites to be visited) and reviewing the field protocol during the visit. The quality control monitors were also available throughout the survey to respond to questions and offer assistance to Data Collectors as needed.

Observation Periods and Quality Control

All seat belt and booster seat use observations were conducted during weekdays and weekends between 7:00 a.m. and 6:00 p.m. The schedule included rush hour (before 9:30 a.m. and after 3:30 p.m.) and non-rush hour observations. Data collection was conducted for 50 minutes immediately following a 5-minute traffic count; a second 5-minute traffic count immediately followed the observation. Observers recorded seat belt use and demographic information of interest to Ohio, both while vehicles were stopped in the designated lane at the traffic control device (if present) and while traffic was moving through the intersection, ramp, or road segment whenever possible. When traffic was moving, observers recorded data for as many vehicles as possible. Approximately 8 counties were covered per day with an average of four or five sites scheduled for each county. Start times were organized to ensure that a representative number of weekday versus weekend and rush hour versus non-rush hour sites were included.

Maps showing the location of all observation sites and Site Assignment Sheets were provided to the Data Collectors and QC Monitors. These indicated the observed road name, the crossroad included within the road segment (or nearest crossroad), assigned date, assigned time, and assigned direction of travel. Sites within relatively close geographic proximity were assigned as data collection clusters. The first site within each cluster was assigned a random day and time for completion. Next, all other sites within a cluster were assigned to the same day by geographic proximity in order to minimize travel costs.

Data Collection

All passenger vehicles, including commercial vehicles with a gross vehicle weight rating (GVWR) of less than 10,000 pounds, were eligible for observation. The Seat Belt Survey Site Description Form and the Observation Form are shown in Appendix D. The Site Description Form obtains descriptive information for each site, including: date, site location, site number, alternate site data, assigned traffic flow, number of lanes available and observed, start and end times for observations, and weather conditions. This form was completed by the Data Collector at each observation site.

The Seat Belt Survey Observation Form was used to record seat belt use by drivers and front seat passengers. Additional forms were provided for each observer since some sites had a significantly higher traffic volume than average. After being reviewed by QC Monitors, the forms were scanned and the data were imported directly into a database for analysis.

The data collectors observed as many lanes of traffic as they could accurately monitor while obtaining data on 99% of the vehicles. Only one direction of traffic was observed at any given site.

Observations were made of all drivers and right front seat occupants, including children riding in booster seats. The only right front seat occupants excluded from the analysis were child passengers who were traveling in child seats with harness straps.

Alternate Sites and Rescheduling

When a site was temporarily unavailable due to a crash or inclement weather, data collection was rescheduled for a corresponding time of day and day of week. In the event that the site was permanently unusable an alternate site, selected as part of the reserve sample, was used as a permanent replacement. The alternate for each site was clearly identified and listed on the Site Assignment Sheet and additional site selection support was provided by the staff member responsible for site selection.

Quality Control Procedures

The Quality Control (QC) Monitors made unannounced visits to at least twelve data collection sites throughout the state. During these visits, the QC Monitor first evaluated the Data Collector's performance from a nonintrusive distance (if possible), and then observed alongside the Data Collector. This procedure helped ensure that the Data Collector followed survey protocol including: being on time at assigned sites, completing the Site Description Form and observation forms, and making accurate observations of seat belt use. In the event it is discovered that a Data Collector falsified data, the Data Collector will be replaced by a back-up Data Collector and the back-up Data Collector will revisit all sites proven to be, or suspected, to be falsified and recollect all data. However, no Data Collector has ever been found to be untrustworthy. At the end of each observation period, the Data Collector shipped the forms by overnight service to Miami University's Applied Research Center (ARC) in Middletown, Ohio. The QC monitors and Applied Research Center Staff reviewed the forms. If the rate of unknowns exceeded 10% for any site (potentially leading to an overall nonresponse rate of 10% or more), then the Data Collector was sent back to that site for an additional observation period. These same procedures were successfully completed in 2016. The ARC reviewed all data submitted by observers and the data were rigorously collected and were found to be statistically consistent and complete.

Statistical Analysis

The Site Description Forms and Data Collection Forms were returned directly to the Miami University Applied Research Center and a cursory review of the forms and data from each observer and site was performed. Site and vehicle-specific information were linked in the final dataset used for statistical analysis. All analyses were performed using a combination of Microsoft Excel, Access, and SPSS.

Estimation and Variance Estimation

Imputation

Imputation on missing data was unnecessary, per the protocol and Ohio's past experience with observational surveys.

Sampling Weights

We selected a stratified random sample within road type strata in each county. In addition, the number of segments selected was small relative to the number of possible road segments. As a consequence, finite population correction factors were not used. Initial sampling weights were defined as the reciprocal of the proportion of segments sampled within a stratum.

Nonresponse Adjustment

The data collection protocol in this plan includes a provision for the use of alternate observation sites and road segments with non-zero eligible traffic volume; consequently, zero observations at a site will be unlikely. However, if no vehicles pass a site during the 50 minute observation period or if the site is closed for some other reason, an alternate site that is paired with the selected site will be used. Consequently, a nonresponse adjustment in these cases will be unnecessary, since the alternative observation site is already associated with the selected observation site. If the alternate site is also unavailable, the site's sampling weight will be redistributed over the other segments of the same road type in its county. Let p_{isj} be the road segment selection probability for observation site j of segment s in county i, and

$$w_{isj} = \frac{1}{p_{isj}}$$

be the road segment weight. Weights for non-missing road segments of the same road type within the same county will be multiplied by the adjustment factor for a nonresponding site,

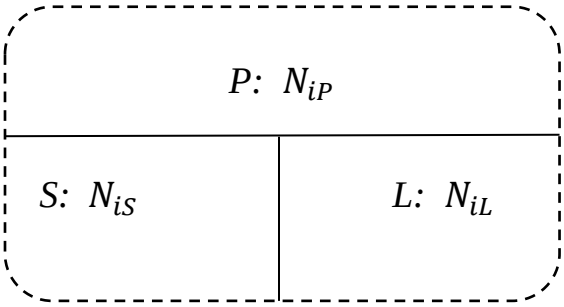
$$f_{is} = \frac{\sum_{all\ j} w_{isj}}{\sum_{responding\ j} w_{isj}}$$

and the missing road segments will be dropped from the analysis file. Moreover, since we will be left with fewer than two observed sites of segment type s within county i, we adjust our estimates by combining strata within the county. In other cases of nonresponse (e.g. cars with unobservable seat belt status), each site's initial sampling weight will be adjusted by multiplying by the reciprocal of its observed response rate. These adjustments are described in Section 5.4.

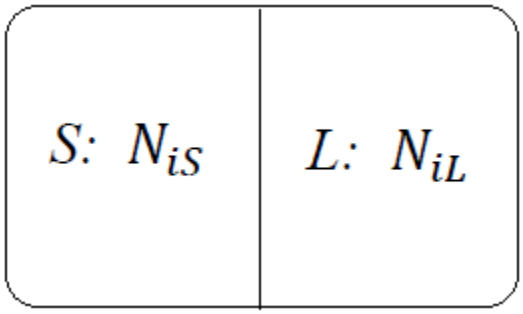
Estimators

5.4.1: Stratification and Allocation

County "i" can be considered a population comprised of 3 strata (i=1, …, 57): "P" = primary; "S" = secondary; and "L" = local segments. The numbers of segments in each stratum are N_{iP}, N_{iS} and N_{iL}, respectively. A county is represented as:



When a county does not have any primary road segments, it is represented as:



The size of the sample from each stratum is n_{iP}=2, n_{iS}=2 and n_{iL}=1, except for counties with 10,000,000 or higher DMVT, in which case n_{iL}=2.

5.4.2: Estimators

Within an observation site, the estimated seat belt use rate $\hat{\pi}_{isj}$ is calculated as:

$$\hat{\pi}_{isj} = \sum \frac{u_{dlv|isj} y_{dlv|isj}}{u_{dlv|isj}},$$

where $u_{dlv|isj}$ is the sampling weight of vehicle v in lane l travelling in direction d, and $y_{dlv|isj} = 1$ if a seat belt is in use and 0 if not. The vehicle sampling weight is defined as $u_{dlv|isj} = \frac{1}{p_{dlv|isj}} = \frac{1}{p_{d|isj} p_{l|isjd} p_{v|isjdl}}$, where, $p_{d|isj}$ represents the probability of traffic direction selection, $p_{l|isjd}$ is the probability of lane selection within direction, and $p_{v|isjdl}$ is the probability of vehicle selection within the lane.

County estimate (stratified estimator, adjusted for nonresponse)

The initial sampling weight for observation site j in stratum s within county i is the reciprocal, $\frac{N_{is}}{n_{is}}$, of the proportion of segments sampled within the stratum. If the response rate at the site is denoted r_{isj}, the nonresponse-adjusted weight, w_{isj}, is obtained by multiplying the initial sample weight by r_{isj}^{-1}; hence, $w_{isj} = \frac{N_{is}}{n_{is} r_{isj}}$. The county estimate for the rate of seat-belt use is then

$$\hat{\pi}_{C_i} = \frac{\sum_{s \in \{P,S,L\}} \sum_{j=1}^{n_{is}} w_{isj} \hat{\pi}_{isj}}{\sum_{s \in \{P,S,L\}} \sum_{j=1}^{n_{is}} w_{isj}}.$$

Region estimate

Suppose counties C_1, ... , C_R comprise a region. Then the region seat belt use estimate is given by

$$\hat{\pi}_{region} = \sum_{i=1}^{R} \left(\frac{N_{C_i}^*}{N_{region}^*} \right) \hat{\pi}_{C_i},$$

where $N_{region}^* = \sum_{i \in region} N_i^*$.

State estimate

The Ohio seat belt use estimate and its variance are similarly defined:

$$\hat{\pi}_{state} = \sum_{i=1}^{57} \left(\frac{N_i^*}{N_{state}^*} \right) \hat{\pi}_{C_i},$$

where $N_{state}^* = \sum_{i=1}^{57} N_i^*$.

5.4.3: Variance Estimation

To derive an estimate for the variance of $\hat{\pi}_{C_i}$, we first note that the county seat-belt use estimate above can be re-expressed as the algebraically-equivalent weighted-average of stratum-specific estimates:

$$\hat{\pi}^*_{C_i} = \sum_{s\in\{P,S,L\}} W^*_{is}\hat{\pi}_{is} = \frac{1}{N^*_i}\sum_{s\in\{P,S,L\}} N^*_{is}\hat{\pi}_{is}\,.$$

In addition to suggesting that counties are strata in the state, we are suggesting the use of stratified sampling of segment type {P, S, L} within each county. Thus, the county estimate is constructed as a weighting of estimates from each segment strata in a county. Here W_{is}* is the (non-response adjusted) proportion of road segments in county "i" that are of types. Note that this differs from the N_i*/N_{state}* weights that are used to combine county estimates into a state or region estimate.

In defining the component quantities, of $\hat{\pi}_{C_i}$ above, we take advantage of the fact that any stratum will have at most two observation sites (that is, $n_{is} \le 2$). For a stratum with two observation sites, we define the nonresponse-adjusted effective stratum size as $N^*_{is} = \frac{N_{is}}{2}\left(\frac{1}{r_{is1}} + \frac{1}{r_{is2}}\right)$ and the nonresponse-adjusted stratum seat belt use estimate as $\hat{\pi}_{is} = \hat{\pi}_{is1}\left(\frac{r_{is2}}{r_{is1}+r_{is2}}\right) + \hat{\pi}_{is2}\left(\frac{r_{is1}}{r_{is1}+r_{is2}}\right)$. For a stratum with only one observation site, these quantities are defined as $N^*_{is} = \frac{N_{is}}{r_{is1}}$ and $\hat{\pi}_{is} = \hat{\pi}_{is1}$. The overall effective county size is $N^*_i = N^*_{iP} + N^*_{iS} + N^*_{iL}$, and the final weights for in the formula above are given by $W^*_{iP} = \frac{N^*_{iP}}{N^*_i}$, $W^*_{iS} = \frac{N^*_{iS}}{N^*_i}$, and $W^*_{iL} = \frac{N^*_{iL}}{N^*_i}$, the nonresponse-adjusted effective proportion of each segment type sampled in county i.

When $n_{iL} = 1$, we combine the local and secondary sites together into a new strata (denoted with a subscript "N") to obtain the estimated variance of $\hat{\pi}^*_{C_i}$,, i.e., there are two stratum considered in the variance estimation, primary and secondary/local. Then estimated variance of $\hat{\pi}^*_{C_i}$ can then be expressed as

$$\hat{V}\left(\hat{\pi}^*_{C_i}\right) = \sum_{s\in\{P,N\}}\left[\frac{W^{*2}_{is}}{n_{is}}\sum_{j=1}^{n_{is}}\frac{\left(\hat{\pi}_{isj} - \hat{\pi}_{is}\right)^2}{n_{is}-1}\right].$$

- assuming the secondary and local sites are homogeneous
- $W^*_{iP} = \frac{N^*_{iP}}{N^*_i}$, $W^*_{iN} = \frac{N^*_{iS}+N^*_{iL}}{N^*_i}$
- ignoring FPC since $N_{iS} >> n_{iS}$

If $n_{iL} = 0$ because of nonresponse, i.e., neither the initially sampled site nor the reserve sample site is available, cells will be collapsed across strata within county in a similar manner.

Bound on error of estimate = $2\sqrt{\hat{V}\left(\hat{\pi}^*_{C_i}\right)}$

Confidence interval: $\hat{\pi}^*_{C_i} \pm 2\sqrt{\hat{V}\left(\hat{\pi}^*_{C_i}\right)}$

The variance of the region estimate is given by

$$\hat{V}\left(\hat{\pi}_{region}\right) = \sum_{i=1}^{R}\left(\frac{N^*_{C_i}}{N^*_{region}}\right)^2 \hat{V}\left(\hat{\pi}^*_{C_i}\right).$$

Error bounds and confidence intervals for the regional estimates are defined similarly to those for county estimates.

The variance of the state estimate is given by

$$\hat{V}(\hat{\pi}_{state}) = \sum_{i=1}^{57}\left(\frac{N^*_i}{N^*_{state}}\right)^2 \hat{V}\left(\hat{\pi}^*_{C_i}\right).$$

The error bound and confidence interval for the state estimate is defined similarly to those for county estimates.

All computations were performed using standard statistical software, such as SPSS, proc surveyreg in SAS, or the survey package in R.

RESULTS

Statewide Seat Belt Use

The official 2017 overall seat belt use rate for vehicle occupants from Ohio is 82.8% (Table 3), within the margin of error of the 2016 rate of 83.8%. Due to the large sample size of 23,193 occupant observations (18,601 drivers plus 4,592 passengers), the survey has a confidence interval of approximately plus or minus 1.0%. An average of 80 vehicles and 100 occupants were observed per site.

Alone, the 2017 rate is a point estimate of seat belt use. Applying a confidence interval determines a range of values that allows seat belt use to be estimated with a desired amount of certainty. NHTSA guidelines specify a 95% confidence level and a confidence interval of plus or minus 5%. Using the statistical weighting procedures outlined in the methodology, we can be **95% certain** that Ohio's seat belt usage for all vehicle occupants is within approximately ± **1.0% of 82.8%**.

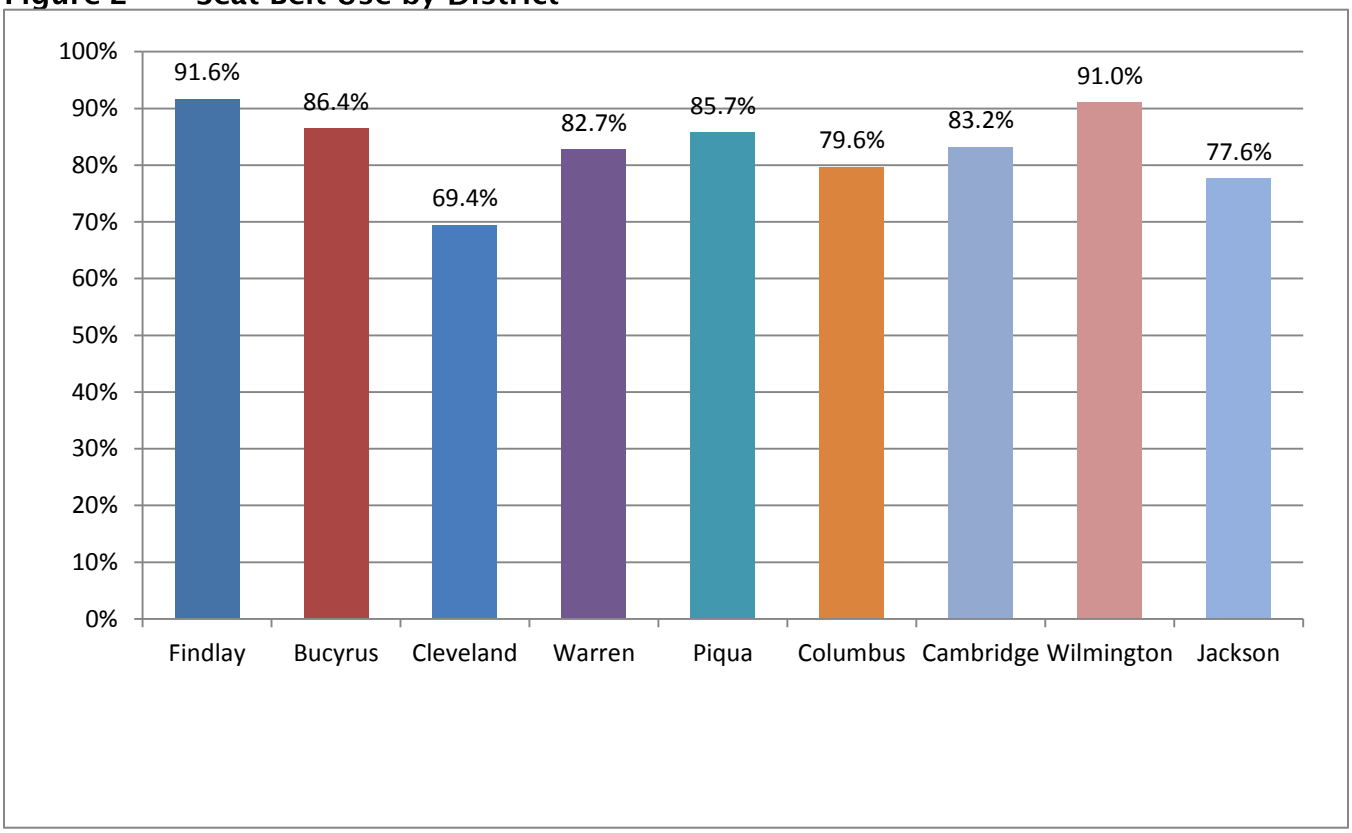
95% Confidence Interval: **81.8% - 83.8%**

OSHP District Seat Belt Use

As illustrated in Table1 and Figure 2, Cleveland and Jackson Ohio State Highway Patrol (OSHP) Districts have lower seat belt use rates than other districts.

Table 1: OSHP District Usage Rates **OSHP**	Usage Rate	Standard Error	Lower Bound	Upper Bound	Unweighted N
Findlay	91.6%	0.0081	0.9000	0.9318	2,772
Bucyrus	86.4%	0.0496	0.7671	0.9617	3,098
Cleveland	69.4%	0.0395	0.6164	0.7711	3,793
Warren	82.7%	0.0153	0.7969	0.8568	3,276
Piqua	85.7%	0.0269	0.8042	0.9098	2,188
Columbus	79.6%	0.0616	0.6755	0.9169	4,099
Cambridge	83.2%	0.0337	0.7664	0.8984	1,091
Wilmington	91.0%	0.0104	0.8895	0.9301	2,377
Jackson	77.6%	0.0498	0.6784	0.8737	499
Statewide	**82.8%**	**0.0149**	**0.7983**	**0.8568**	**23,193**

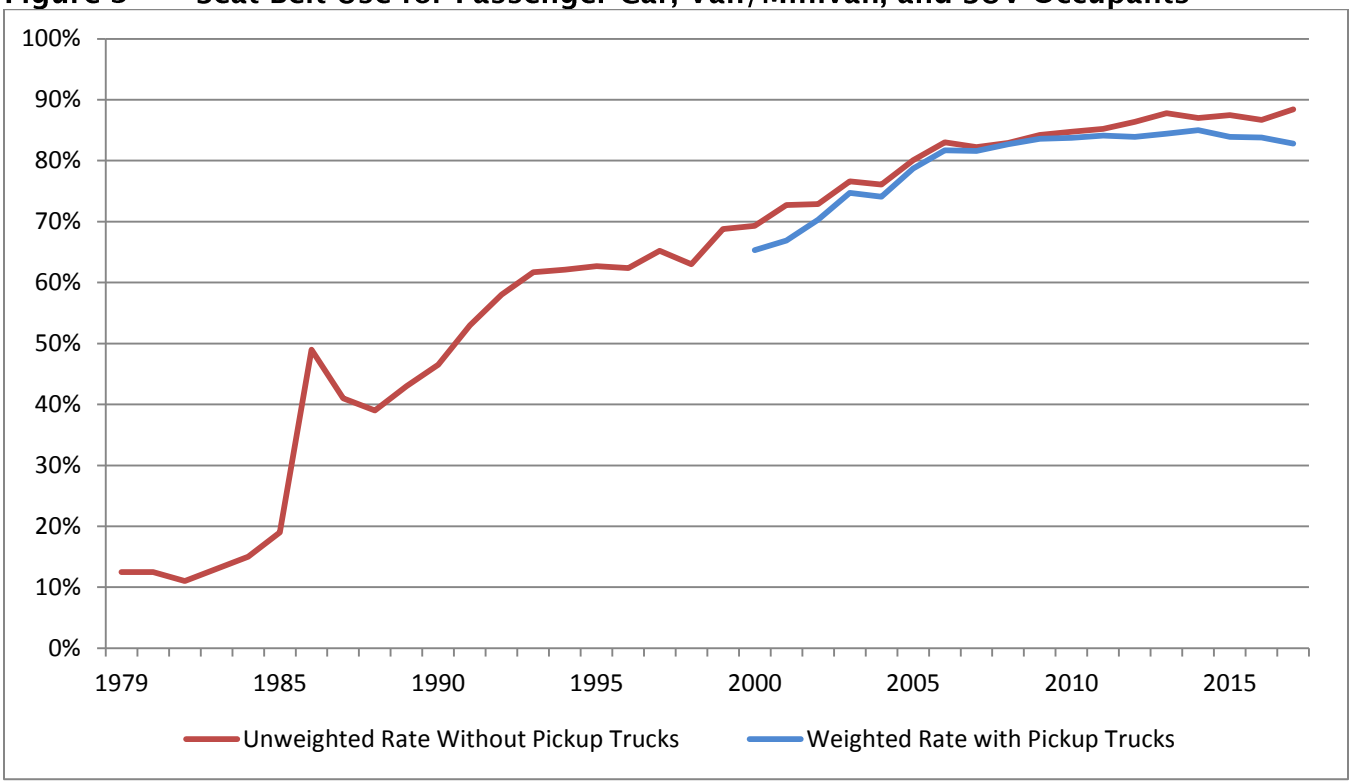
Figure 2 Seat Belt Use by District



It is important to note that the overall seat belt use estimate is based on all front outboard occupants observed in five vehicle types.[1] Because pickup trucks were excluded from the survey until 1998, the 2017 rate is only comparable to rates since 1998. Calculating the unweighted 2017 rate without trucks indicates a usage rate of approximately 88.4%, highlighting the detrimental effect of low seat belt use rates among truck occupants on the overall seat belt use rate. Figure 3 represents un-weighted seat belt usage excluding pickup trucks (in red). In comparison, the weighted rate including pickup trucks (in blue) shows that while the rate without pickup trucks is higher than when they are included, the rates converged until 2012, when the new methodology was implemented.

Commercial vehicles were excluded from these historically comparable rates as specified by NHTSA.

Figure 3 Seat Belt Use for Passenger Car, Van/Minivan, and SUV Occupants



[1] Data on four vehicle types—passenger cars, vans/minivans, sport utility vehicles, and pickup/light trucks—have been collected since the 1998 survey. The 2012 methodology update subdivided trucks into "light" and "heavy" classes; both are excluded from the unweighted rate in Figure 3.

Vehicle Type and Seat Belt Use

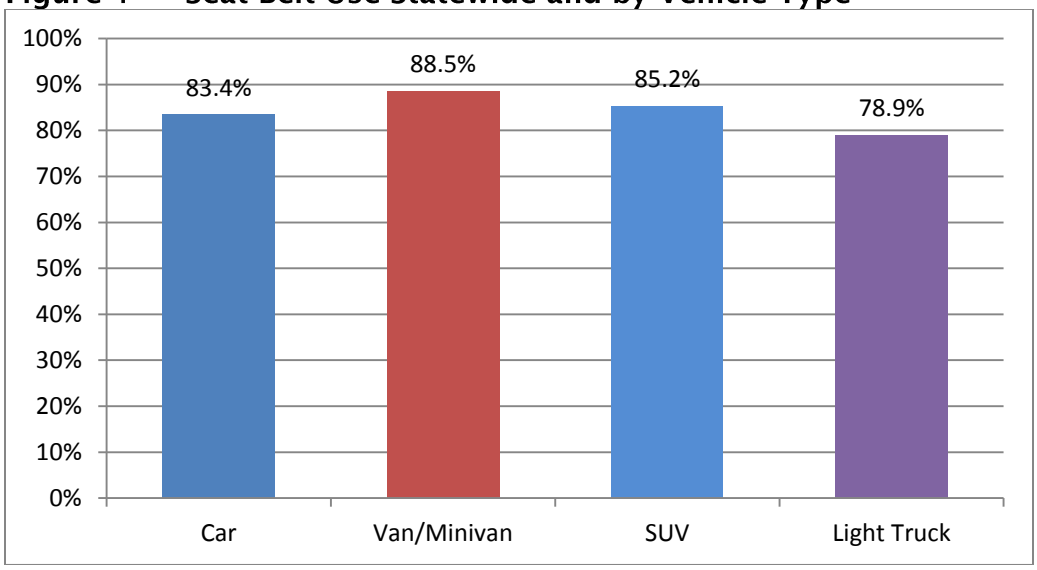
Following the pattern of previous surveys and expectations, light truck occupants had a significantly lower seat belt use rate than occupants of other vehicles types during 2016, presenting an opportunity to increase overall seat belt use in the future (see Table 2).

Table 2: Seat Belt Use by Vehicle Type[2]

			95% Confidence Interval		
Vehicle Type	**Usage Rate**	**Standard Error**	**Lower Bound**	**Upper Bound**	**Unweighted n**
Passenger Car	83.4%	0.0105	0.8047	0.8642	10,044
Van/Minivan	88.5%	0.0208	0.8437	0.9253	2,179
SUV	85.2%	0.0262	0.8006	0.9033	6,865
Light Truck	78.9%	0.0138	0.7619	0.8163	3,673
Statewide	**82.8%**	**0.0149**	**0.7983**	**0.8568**	**23,149**

Figure 4 illustrates the extent to which van/minivan and SUV occupant seat belt use exceeds the passenger car occupant use rate and, especially, the light truck occupant use rate.

Figure 4 Seat Belt Use Statewide and by Vehicle Type



The results for each vehicle type by OSHP district are presented in Table 3. As shown, occupants of light trucks had a significantly lower rate of seat belt use than occupants in all other vehicle types in every district. Seat belt use was lowest among light truck occupants in the Warren, Cleveland and Jackson districts.

[2] Insufficient heavy truck observations for accurate weighting. Unweighted rate is 80.1% of 388 occupants.

Table 3: Vehicle Type Usage Rates by OSHP District

Region	Passenger Car	Unweighted N	Van / Minivan	Unweighted N	SUV	Unweighted N	Light Truck	Unweighted N
Findlay	93.8%	1,315	95.1%	304	93.3%	666	79.6%	466
Bucyrus	87.1%	1,180	86.8%	254	89.7%	1,086	80.7%	477
Cleveland	70.6%	1,624	81.9%	323	7.5%	1,170	68.0%	591
Warren	81.4%	1,404	90.8%	270	87.2%	1,016	79.3%	517
Piqua	85.4%	1,041	90.6%	225	92.5%	547	87.8%	364
Columbus	78.7%	1,676	85.8%	462	81.9%	1,248	77.6%	621
Cambridge	78.3%	352	96.5%	88	84.0%	397	75.5%	222
Wilmington	94.3%	1,244	90.7%	199	89.9%	609	83.3%	311
Jackson	80.4%	208	79.4%	54	85.5%	126	64.1%	104
Statewide	83.4%	**10,044**	88.5%	**2,179**	85.2%	**6,865**	78.9%	**3,673**

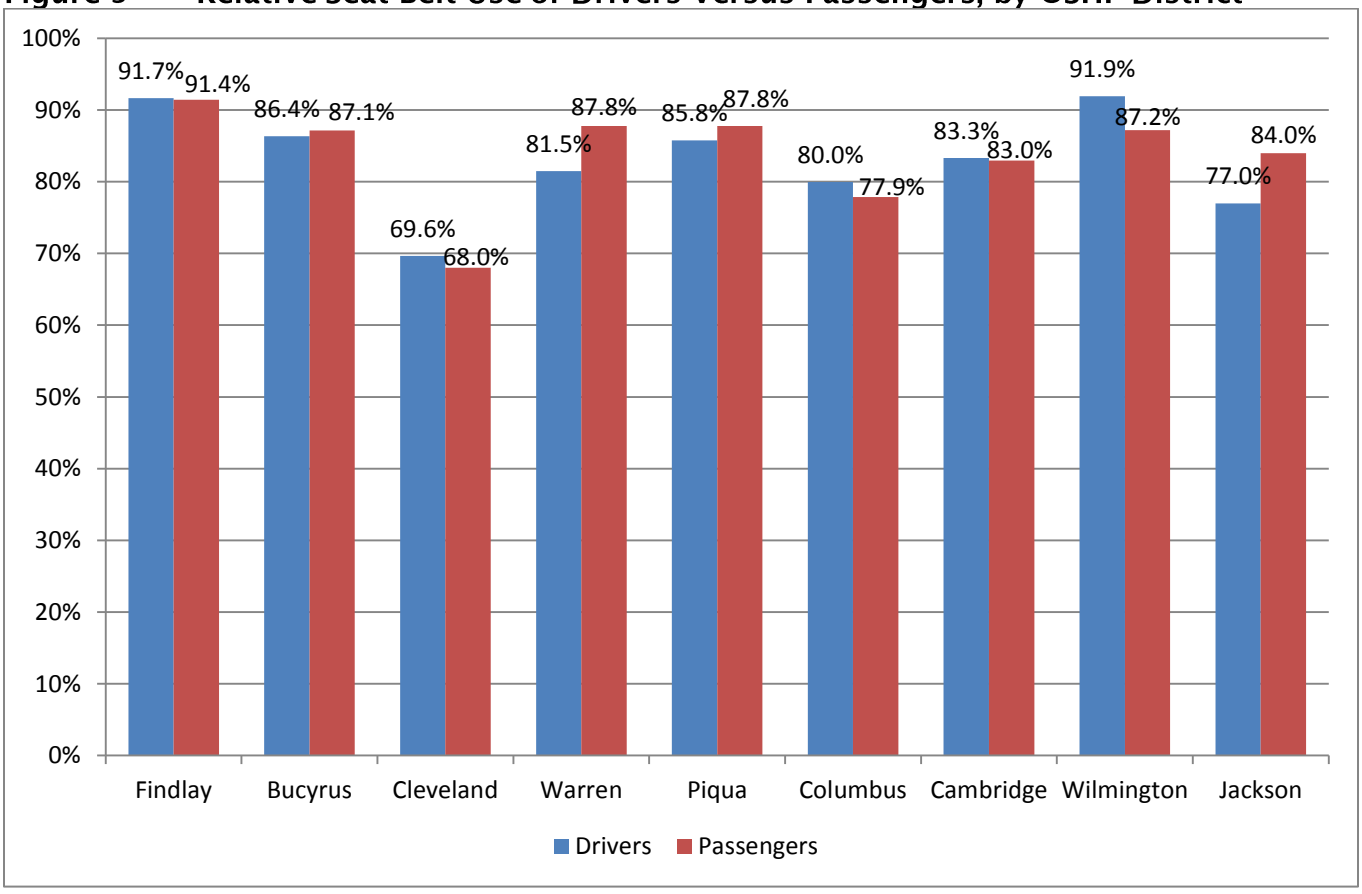
Driver and Passenger Seat Belt Use

Ohio's seat belt observation survey has traditionally found differences between drivers and passengers in their rates of seat belt use, although the two rates are strongly correlated and reciprocal. Table 4 depicts the results for drivers and passengers, respectively, by OSHP district. Meanwhile, Figure 5 illustrates the relative differences by OSHP districts.

Table 4: Driver and Passenger Usage Rates by OSHP District

Region	Drivers	Unweighted N	Passengers	Unweighted N
Findlay	91.7%	2,247	91.4%	690
Bucyrus	86.4%	2,332	87.1%	867
Cleveland	69.6%	3,095	68.0%	1,184
Warren	81.5%	2,583	87.8%	974
Piqua	85.8%	1,791	87.8%	546
Columbus	80.0%	3,288	77.9%	1,044
Cambridge	83.3%	817	83.0%	348
Wilmington	91.9%	2,014	87.2%	454
Jackson	77.0%	434	84.0%	151
Statewide	82.9%	**18,601**	82.3%	**6,258**

Figure 5 Relative Seat Belt Use of Drivers Versus Passengers, by OSHP District



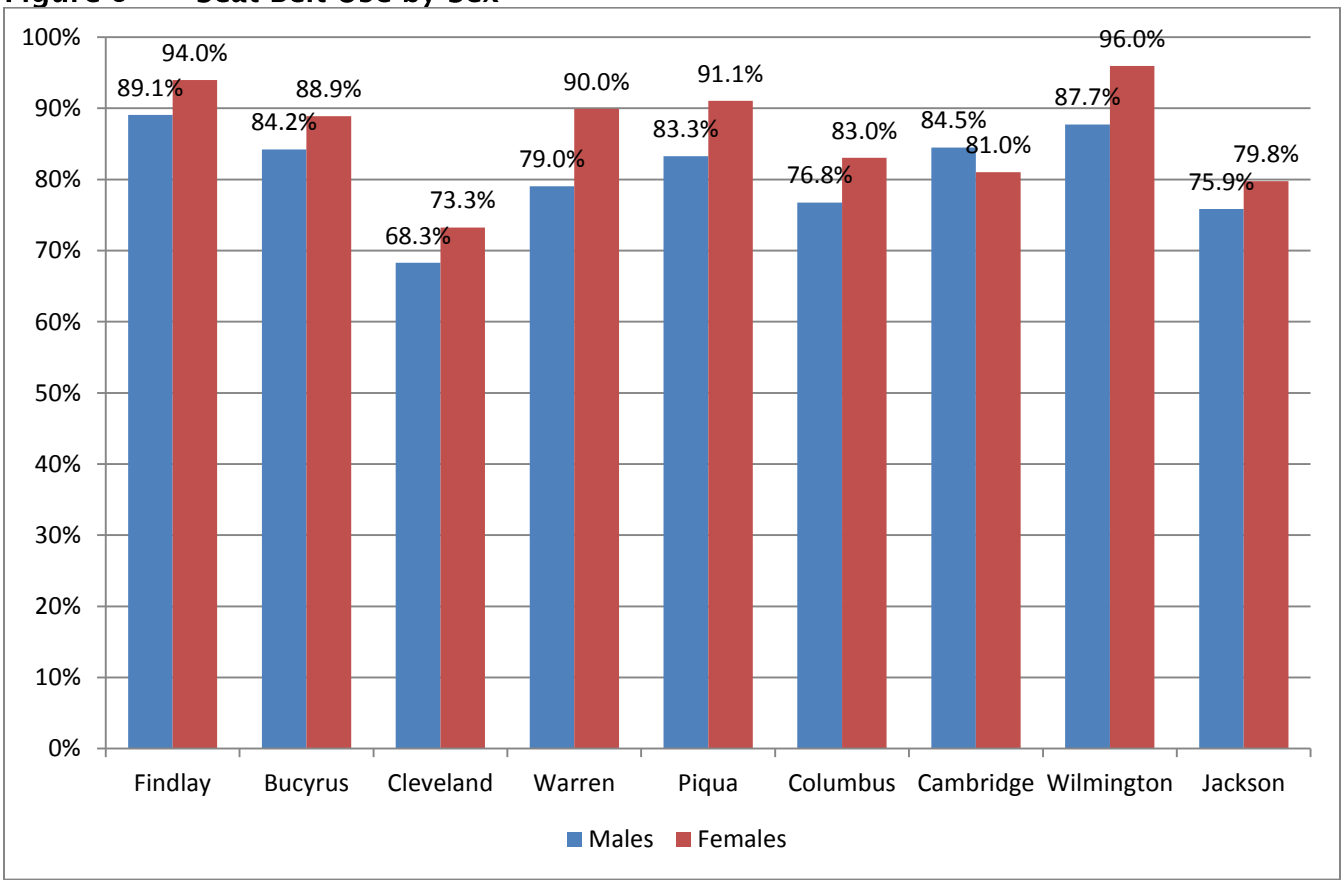
Sex of Vehicle Occupants and Seat Belt Use

Separate estimates were generated for male and female front outboard occupants. Consistent with past Ohio survey results, female occupants had higher rates of seat belt use than did male occupants. The disparity was greatest in the Warren district and least in the Camrbidge district. (Table 5). Figure 6 illustrates a comparison of the results by district.

Table 5: Male and Female Usage Rates by OSHP District

Region	Male	Unweighted N	Female	Unweighted N
Findlay	89.1%	1,316	94.0%	1,455
Bucyrus	84.2%	1,562	88.9%	1,517
Cleveland	68.3%	2,043	73.3%	1,722
Warren	79.0%	1,799	90.0%	1,455
Piqua	83.3%	1,192	91.1%	992
Columbus	76.8%	2,170	83.0%	1,889
Cambridge	84.5%	588	81.0%	503
Wilmington	87.7%	1,255	96.0%	1,119
Jackson	75.9%	292	79.8%	198
Statewide	80.4%	**12,217**	86.7%	**10,850**

Figure 6 Seat Belt Use by Sex



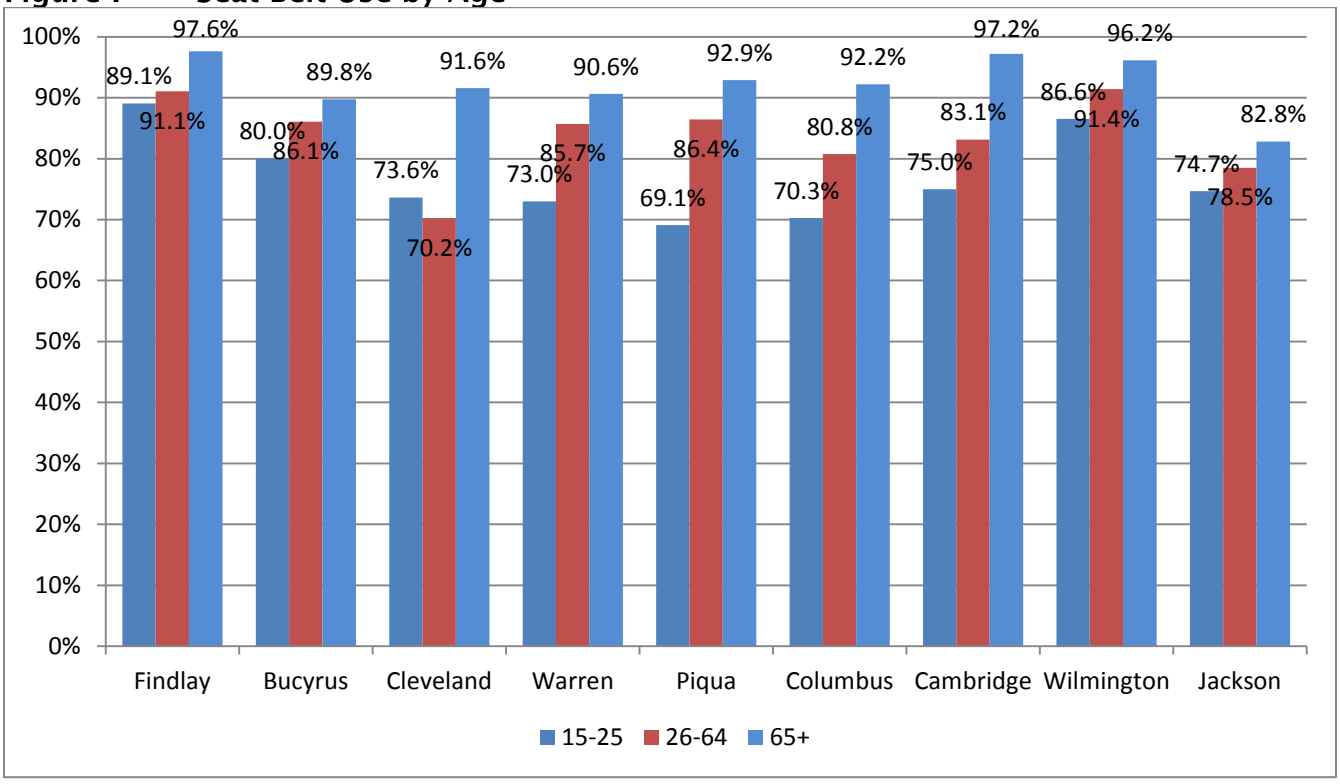
Age of Vehicle Occupants and Seat Belt Use

Compared to other age groups, seat belt use was lowest (77.6%) among vehicle occupants age 15-25. However, seat belt use increases among older occupants, reaching 93.3% among occupants age 65 and older. Table 6 summarizes the results for each age group by OSHP district. A comparison of these results by district is contained in Figure 7.

Table 6: Age Group Usage Rates by OSHP District

Region	15-25	Unweighted N	26-64	Unweighted N	65+	Unweighted N
Findlay	89.1%	404	91.1%	1,955	97.6%	342
Bucyrus	80.0%	347	86.1%	2,154	89.8%	498
Cleveland	73.6%	275	70.2%	3,265	91.6%	197
Warren	73.0%	830	85.7%	1,900	90.6%	466
Piqua	69.1%	341	86.4%	1,514	92.9%	292
Columbus	70.3%	741	80.8%	2,518	92.2%	722
Cambridge	75.0%	116	83.1%	785	97.2%	162
Wilmington	86.6%	493	91.4%	1,396	96.2%	445
Jackson	74.7%	106	78.5%	313	82.8%	62
Statewide	**77.6%**	**3,653**	**83.6%**	**15,800**	**93.3%**	**3,186**

Figure 7 Seat Belt Use by Age



There were too few occupants younger than 15 to accurately estimate seat belt use for children. Historically, however, children's restraint use has been relatively low and may be hampered by parents' misunderstanding of, or simply not owning, booster and/or safety seats for the youngest passengers.

Race of Vehicle Occupants and Seat Belt Use

Beginning in 2004, the observation survey assessed seat belt use by race: Caucasian, African-American, and individuals of other races ("other"). The present observation methodology precluded the collection of more detailed race information; therefore, these surveys provide data on seat belt use primarily by Caucasians and African-Americans. Also, due to the demographic characteristics of Ohio and the difficulty of clearly determining race with the current methodology, the number of vehicle occupants identified as African-American was relatively small (n = 1,832) and is probably an underrepresentation of the number of African-American drivers and front-seat passengers using Ohio roads. Due to the low number of African-Americans in the survey, an accurate weighted estimate of their seat belt use rate was unable to be determined with accuracy. The Cleveland OSHP district has more than twice as many observations of African-Americans as the next closest district of Columbus, so rates in that district may be more representative than others. Table 7 shows unweighted rates for both African-Americans and Caucasians, but these results should be interpreted with caution. The weighted rates for Caucasians are included in the final column for comparison.

The lack of observed data for African-Americans presents both a challenge and opportunity for increasing overall seat belt use in Ohio, and reducing the number of fatalities and serious injuries suffered by African-Americans.

Table 7: Racial/Ethnic Group Usage Rates by OSHP District

Region	African-American	Unweighted N	Caucasian	Unweighted N	Caucasian (Weighted Rates)
Findlay	80.5%	185	81.1%	2,571	92.1%
Bucyrus	72.3%	173	75.4%	2,875	88.2%
Cleveland	84.4%	532	81.3%	3,177	73.9%
Warren	80.6%	324	78.9%	2,900	82.8%
Piqua	80.8%	104	82.1%	2,062	86.4%
Columbus	81.1%	312	80.0%	3,614	90.1%
Cambridge	81.0%	21	74.8%	1,065	83.0%
Wilmington	82.1%	156	85.1%	2,191	91.3%
Jackson	96.0%	25	86.0%	465	78.4%
Statewide	**81.3%**	**1,832**	**80.2%**	**20,920**	86.0%

Observation Road Designation and Seat Belt Use

Table 8 and Figure 8 summarize the results for usage by observation site designation. These designations consist of primary segments (interstate highways), secondary segments (U.S. and state routes), and "local" segments which include municipal and rural routes such as city surface streets, township highways, and other routes under the jurisdiction of local authorities. In the current study, primary segment observations were made at freeway exit ramps, while secondary and local segments were made at non-ramp locations, predominantly intersections.

Since there are fewer municipal roads in the survey and comparatively fewer observations for municipal routes, the weighted estimate for such roads was unable to be accurately determined. Also, the Jackson district, being the most rural district, included only secondary segments.

Table 8: Seat Belt Use by Road Type and OSHP District (Weighted)

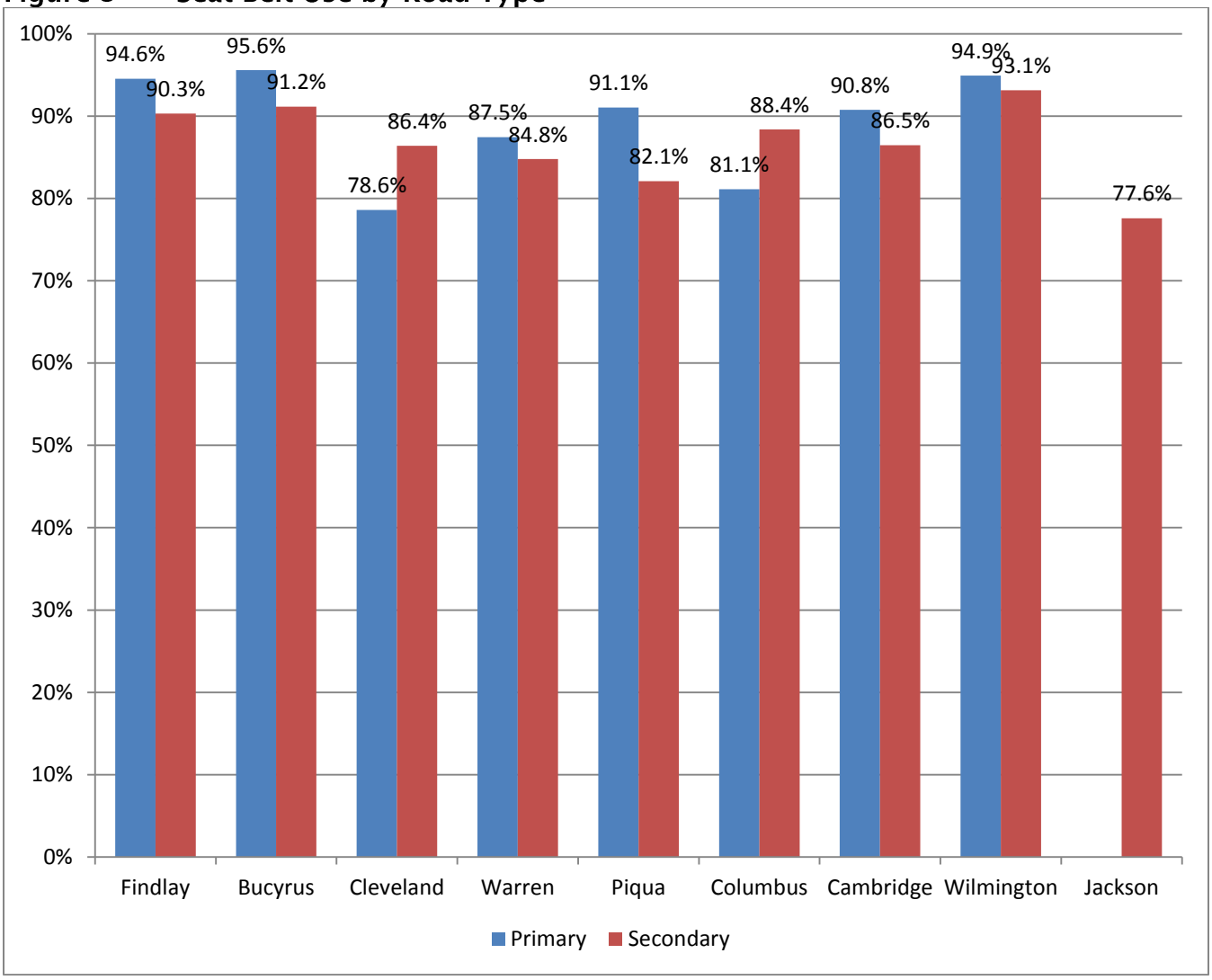
Region	Primary	Unweighted N	Secondary	Unweighted N
Findlay	94.6%	803	90.3%	1,535
Bucyrus	95.6%	854	91.2%	2,175
Cleveland	78.6%	1,507	86.4%	1,913
Warren	87.5%	1,190	84.8%	1,858
Piqua	91.1%	989	82.1%	1,006
Columbus	81.1%	1,505	88.4%	1,949
Cambridge	90.8%	482	86.5%	564
Wilmington	94.9%	1,003	93.1%	973
Jackson	-	-	77.6%	499
Statewide	**89.1%**	**8,333**	**87.7%**	**12,472**

The unweighted rates for primary, secondary, and local roads are contained in Table 9. Figure illustrates the weighted results by road type and region.

Table 9: Seat Belt Use by Road Type and OSHP District (Unweighted)

Region	Primary	Unweighted N	Secondary	Unweighted N	Local	Unweighted N
Findlay	93.6%	803	89.1%	1,535	88.9%	434
Bucyrus	97.0%	854	91.4%	2,175	52.2%	69
Cleveland	84.5%	1,507	82.2%	1,913	62.2%	373
Warren	86.6%	1,190	84.4%	1,858	78.9%	228
Piqua	91.6%	989	82.1%	1,006	88.6%	193
Columbus	88.2%	1,505	88.4%	1,949	81.9%	645
Cambridge	89.8%	482	85.6%	564	73.3%	45
Wilmington	93.4%	1,003	92.0%	973	89.8%	401
Jackson	-	-	77.6%	499	-	-
Statewide	**89.9%**	**8,333**	**86.7%**	**12,472**	**80.7%**	**2,388**

Figure 8 Seat Belt Use by Road Type



Cross-tabulations of Observation Characteristics and Seat Belt Use

The seat belt use rates in Tables 10 through 12 and Figures 9 through 11 are based on several demographic, occupant, and vehicle characteristics. As indicated and consistent with previous survey results, male light truck drivers age 15-25 had the lowest seat belt usage rate of all drivers, while female van/minivan occupants aged 65 years or older had higher rates than other drivers. Many of the passenger seat belt use rates are based on relatively few observations and thus have a larger sampling error. That caveat should be kept in mind when interpreting data in those categories. However, these rates do indicate that passengers of light trucks had relatively low usage rates.

Table 10: Driver and Passenger Usage Rates by Age and Sex

		Drivers	Unweighted N	Passengers	Unweighted N
Ages 15-25	Males	80.3%	1,471	72.9%	388
	Females	87.0%	1,319	84.7%	466
Ages 26-64	Males	85.4%	7,630	79.0%	751
	Females	90.1%	5,689	90.0%	1,661
Ages 65+	Males	91.7%	1,563	89.2%	168
	Females	94.6%	795	92.8%	640

Table 11: Driver and Passenger Usage Rates by Age and Vehicle Type

		Drivers	Unweighted N	Passengers	Unweighted N
Ages 15-25	Passenger Car	84.2%	1,670	76.3%	409
	Van / Minivan	77.1%	131	86.8%	76
	SUV	87.8%	638	84.5%	247
	Light Truck	74.9%	307	77.5%	120
Ages 26-64	Passenger Car	87.2%	5,431	86.5%	876
	Van / Minivan	89.0%	1,272	87.6%	284
	SUV	90.6%	4,010	88.8%	817
	Light Truck	82.2%	2,381	82.1%	393
Ages 65+	Passenger Car	93.5%	1,107	91.4%	352
	Van / Minivan	91.5%	224	90.4%	94
	SUV	96.1%	690	94.8%	271
	Light Truck	84.3%	327	88.1%	85

Table 12: Driver and Passenger Usage Rates by Sex and Vehicle Type

		Drivers	Unweighted N	Passengers	Unweighted N
Males	Passenger Car	86.6%	4,363	79.6%	598
	Van / Minivan	84.9%	845	82.8%	175
	SUV	89.4%	2,518	85.8%	426
	Light Truck	81.2%	2,642	72.7%	288
Females	Passenger Car	88.5%	3,850	87.6%	1,192
	Van / Minivan	92.2%	778	89.4%	369
	SUV	92.4%	2,801	91.3%	1,074
	Light Truck	85.1%	368	88.8%	357

Figure 9 Seat Belt Use by Age and Sex

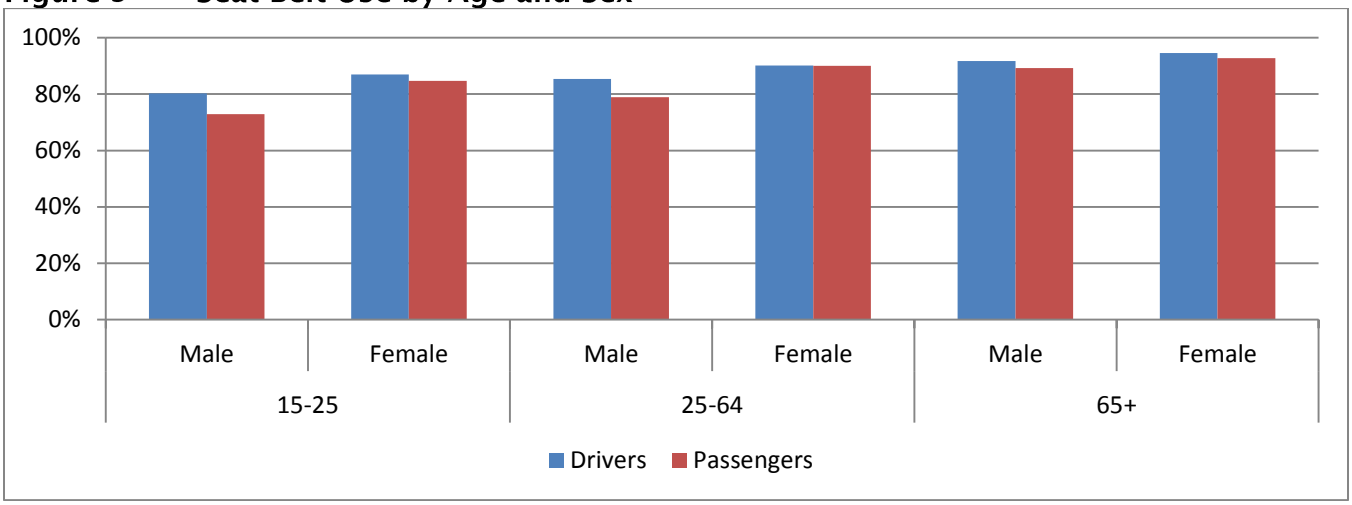


Figure 10 Seat Belt Use by Age and Vehicle Type

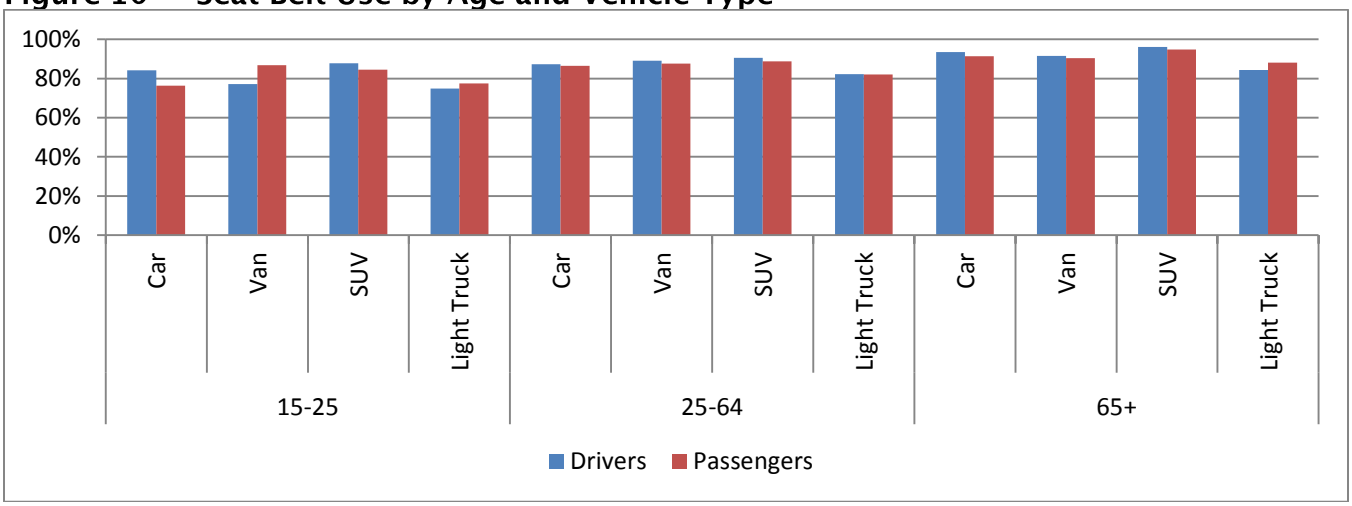
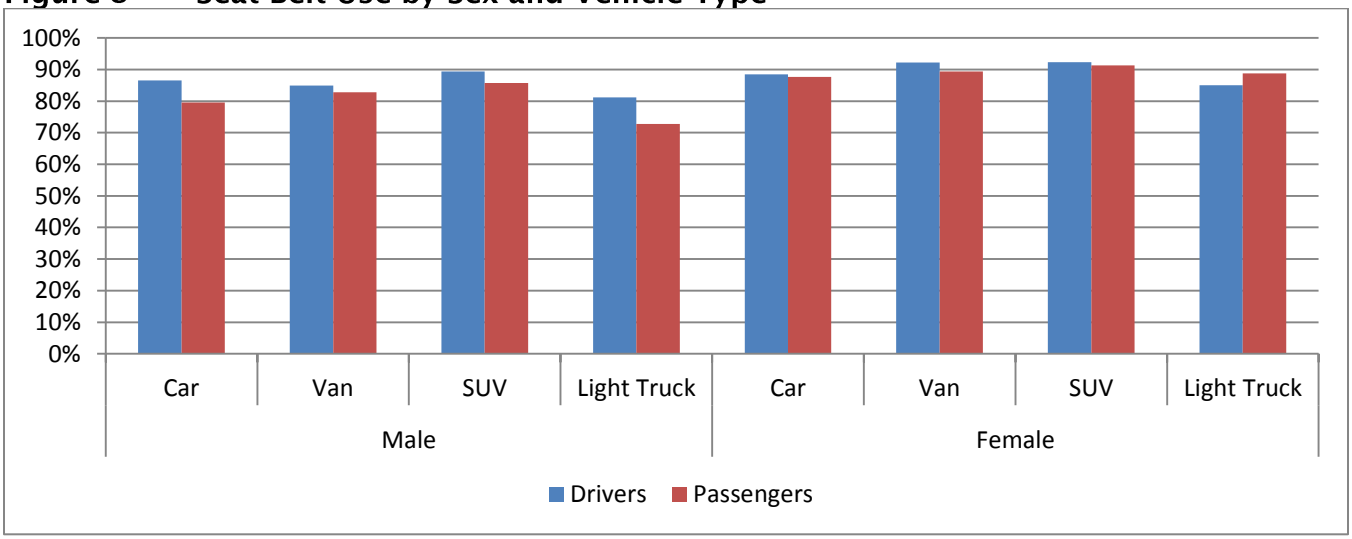


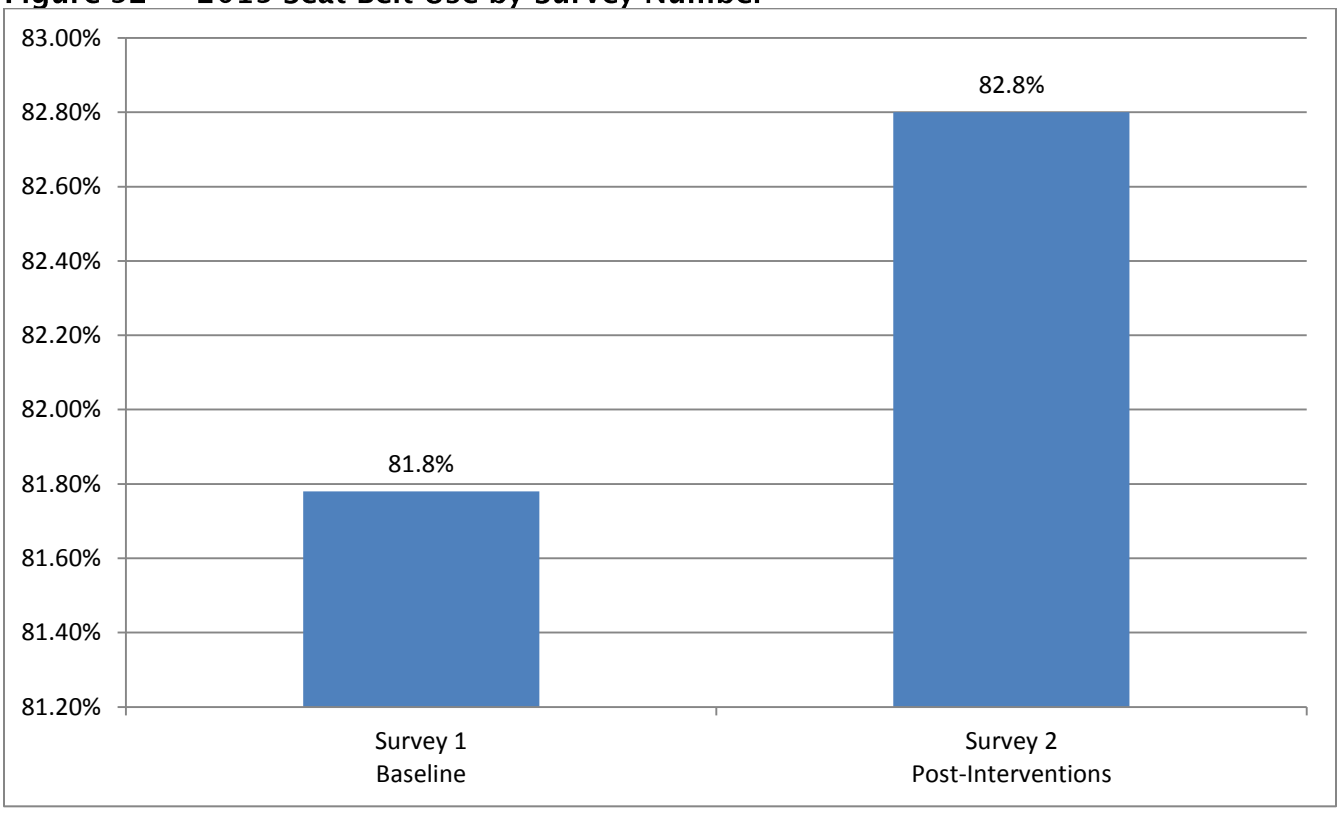
Figure 8 Seat Belt Use by Sex and Vehicle Type



Media and Enforcement Interventions

The 2017 Observational Seat Belt Study reports only results from the second observational survey which occurred in June, after multiple interventions, including media campaigns and enforcement initiatives such as *Click It or Ticket*. Therefore, it is useful to compare usage rates between both surveys, shown in Figure 9. The increase in seat belt use between surveys is consistent with data from prior years. This increase may at least partially be attributed to the efforts by federal and state agencies to encourage seat belt use by Ohio vehicle occupants.

Figure 92 2015 Seat Belt Use by Survey Number



CONCLUSIONS

As reported, the 2017 overall Ohio seat belt use rate is 82.8%, nearly identical to the 2016 rate of 83.8%. Without a primary seat belt law in Ohio, greater compliance with the present secondary seat belt law must occur among those populations that consistently have relatively low rates of seat belt use. Hence, media and enforcement initiatives; which promote greater seat belt use, must be strengthened; become ongoing, rather than periodic; and be directed disproportionately at the following populations:

- Vehicle occupants in rural counties/districts
- Vehicle occupants age 15-25
- Male vehicle occupants
- Light truck occupants

One approach to increasing seat belt use is cited by Williams and Wells (2004: 179). They maintain that what is necessary in the United States to achieve seat belt use rates of 90% or greater is widespread, methodical, and sustained application of enforcement programs, augmented by the use of creative publicity campaigns. Another approach is the passage of a primary seat belt law, which could initially increase overall use rates by as much as 6%. A primary law could continue to increase seat belt use in diminishing increments thereafter, until a state maximum level is reached. The passage of a primary seat belt law could give Ohioans the "push" they need to comply with seat belt laws. A policy white paper by the Applied Research Center outlined Ohioans' support for a primary law and their intent to obey it, based on statewide telephone surveys conducted yearly (Seufert, Kubilius, & Walton, 2007). Public support for a primary law is very promising. However, in absence of a primary seat belt law, Ohio can only strive to achieve a seat belt use rate of 85% or greater through widespread, methodical, and sustained enforcement programs and creative media campaigns directed disproportionately at the above groups who are least compliant with Ohio's existing seat belt law.

RECOMMENDATIONS

The 2017 Observation Survey of Seat Belt Use increases and reaffirms knowledge about Ohioans who are and are not using seat belts. While the survey results show incremental gains in seat belt use overall and in many subpopulations, the following groups have again been identified as meriting special attention due to relatively low usage rates: Vehicle occupants in the Jackson and Cleveland districts; young drivers and their passengers; male drivers and their passengers; and light truck drivers and passengers. For the most part, these groups are identical to those identified during previous surveys. Furthermore, without a state primary seat belt law, increasing compliance with existing law by occupants with these characteristics is necessary to achieve a statewide seat belt use rate of 85% or greater.

1. **Rural OSHP District Vehicle Occupants:** During 2017, compared to other Ohio districts, the Jackson and Cleveland OSHP districts had the lowest seat belt use rates (78% and 69%, respectively). The Jackson district comprises mainly rural counties, only three of which are part of the statewide sample. As a result, most of those observation sites are intersections, which typically have lower usage rates than freeway ramps. Also, a higher proportion of occupants were observed in light trucks in rural districts than in other areas of the state. Once again, light truck drivers and their passengers are a high risk subpopulation. Due to changes in Ohio State Highway Patrol District designations over the years, it is harder to determine why the Cleveland district has low seat belt use in 2016; this could be a statistical anomaly, but close observation going forward is warranted. It is possible there are more out-of-state drivers in this part of the state.

2. **Vehicle Occupants Age 15 -25:** Vehicle occupants age 15-25 remains lower than other age brackets, at 78%. It is much lower in rural districts; for example, the Cleveland district seat belt usage rate of 69% for occupants age 15-25 is lowest of the eight districts. Since motor vehicle crashes are the leading cause of death among people age 15-20 (NHTSA, 2005), increasing seat belt use among young drivers and passengers is especially imperative. Therefore, increased statewide and targeted law enforcement and education initiatives should be directed toward this population. The life-saving rationale for greater seat belt use should be clearly emphasized. Also, innovative drivers' education programs and other initiatives aimed at increasing driving skill, knowledge, judgment, and personal responsibility among novice drivers would be highly beneficial.

3. **Male Vehicle Occupants:** Overall, male drivers and passengers are significantly less likely to wear seat belts in comparison with female drivers and passengers. For instance, during 2017 and previous years, male driver and passenger seat belt usage rates were significantly lower than rates for female passengers regardless of vehicle type. Thus, messages designed to promote belt use should be directed specifically to males and their "significant others." By appealing to their sense of responsibility toward their families, children, and friends, as well as emphasizing the tangible safety benefits, male seat belt use should increase. Coupled with strict law enforcement, this multi-faceted effort would increase seat belt use among males both while driving and riding as passengers.

4. **Light Truck Occupants:** The 2017 light truck occupant seat belt use rate has improved somewhat, with a rate of 82.8%. As in previous years, light truck occupants (formerly designated as pickup truck occupants) are one of the most important groups on which to focus media and enforcement initiatives. These individuals, and especially male pick-up truck drivers and their passengers of all ages, generally have significantly lower seat belt usage rates than occupants of other vehicles. The exception in 2017 are light truck occupants in the Wilmington and Findlay OSHP districts, both with seat belt use rates of 94%. Among male occupants of light trucks, 81% of drivers and 73% of passengers wore seat belts. In contrast, usage rates are 85% for female light truck drivers and 89% for female light truck passengers. The usage rate is also low for light truck drivers and passengers ages 15 to 25, at 75% and 78%, respectively. Overall, 15% of drivers and passengers occupied light trucks during the 2017 survey. Based on the percentage of all registered vehicles in Ohio that are light trucks, the percent that are involved in fatal crashes, and the low compliance with seat belt law among light truck occupants, this group is at higher risk for death or serious injury from crashes. Therefore, increasing seat belt use among light truck drivers and passengers, especially males, is very important to reduce Ohio's traffic-related fatalities and serious injuries.

In summary, innovative and sustained actions by the ODPS and the OJCS on the above four recommendations should be directed disproportionately at the above "high risk" groups in order to achieve significantly higher seat belt use in Ohio. In addition, concerned Ohioans should continue to pursue the passage of a primary seatbelt law. For instance, surveys of a representative sample of Ohioans with valid driver's licenses illustrate that a majority would favor a primary seat belt law for the state, would obey such a law, and believe a primary law would have a significant positive impact on highway safety in Ohio (Seufert et. al., 2003-2009). Furthermore, a state can expect to experience a marked increase in seat belt use—perhaps 5% or more—with the passage of a primary seat belt use law. This may be particularly important in light of the fact that seat belt use has increased only incrementally during the last decade. Therefore, positive outcomes on seat belt use resulting from ODPS and OJCS actions on the above four recommendations would be further enhanced and sustained by passage of a primary seatbelt law.

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Appendix A: Site Locations and Sampling Weights

Site #	OHSP Region	County	Segment Type	Road to be Observed	Latitude	Longitude	Sampling Weight
1	Findlay	Allen	Primary	I- 75	40.7840	-84.0507	83
2	Findlay	Allen	Primary	I- 75	40.7790	-84.0580	83
3	Findlay	Allen	Secondary	SR-309 / N Jameson Ave	40.7453	-84.1245	865.5
4	Findlay	Allen	Secondary	SR-117 / Bellfontaine Ave	40.7348	-84.0864	865.5
5	Findlay	Allen	Municipal	N Main St	40.7453	-84.1050	10869
6	Findlay	Defiance	Secondary	US Rte 24	41.2753	-84.4220	790.5
7	Findlay	Defiance	Secondary	SR-2 / SR-49 / E High St	41.2971	-84.7566	790.5
8	Findlay	Fulton	Primary	I- 80	41.5907	-84.2635	73
9	Findlay	Fulton	Primary	I- 80	41.5935	-84.1393	73
10	Findlay	Fulton	Secondary	SR-2 / Main St	41.5738	-84.0119	660.1821
11	Findlay	Fulton	Secondary	State Rte 66	41.5546	-84.3068	655.5
12	Findlay	Fulton	Municipal	Co Rd H	41.5880	-84.1134	6279
13	Findlay	Hancock	Primary	I- 75	41.0294	-83.6728	89.5
14	Findlay	Hancock	Primary	I- 75	41.0948	-83.6600	89.5
15	Findlay	Hancock	Secondary	US-23 / N Countyline St	41.1589	-83.4212	587
16	Findlay	Hancock	Secondary	State Rte 18 / Van Buren St	41.1594	-83.5124	587
17	Findlay	Lucas	Primary	I- 280	41.6757	-83.5152	296
18	Findlay	Lucas	Primary	I- 75	41.6917	-83.5103	296
19	Findlay	Lucas	Secondary	SR-51 / Monroe St	41.6958	-83.6361	823.5
20	Findlay	Lucas	Secondary	US-20 / SR-120 / W Central Ave	41.6736	-83.7390	823.5
21	Findlay	Lucas	Municipal	Sandra Dr	41.7113	-83.6147	11156
22	Findlay	Lucas	Municipal	Lewis Ave	41.7003	-83.5659	11267.56
23	Findlay	Wood	Primary	I- 75	41.3562	-83.6216	248
24	Findlay	Wood	Primary	I- 75	41.3433	-83.6243	248
25	Findlay	Wood	Secondary	SR-18 / Deshler Rd	41.1746	-83.5925	904
26	Findlay	Wood	Secondary	SR-795 / Avenue Rd	41.5649	-83.5892	904
27	Findlay	Wood	Municipal	E Gypsy Lane Rd / Co Rd 324	41.3563	-83.6208	11082
28	Bucyrus	Crawford	Secondary	SR-4 / Sandusky Ave	40.9545	-82.9419	984.5
29	Bucyrus	Crawford	Secondary	US-30 / Bucyrus Bypass	40.8179	-82.9403	984.5
30	Bucyrus	Erie	Primary	I- 80	41.3407	-82.7627	66.34737
31	Bucyrus	Erie	Primary	I- 80	41.3283	-82.5043	66
32	Bucyrus	Erie	Secondary	US-6 / Warren St	41.4494	-82.7002	714.7164
33	Bucyrus	Erie	Secondary	SR-13 / Main St	41.3882	-82.5614	705.1935
34	Bucyrus	Huron	Secondary	US Rte 224	41.0296	-82.4911	1125.5
35	Bucyrus	Huron	Secondary	State Rte 60	41.1384	-82.4096	1143.653
36	Bucyrus	Marion	Secondary	SR-95 / Mt Vernon Ave	40.5811	-83.0890	464.7137
37	Bucyrus	Marion	Secondary	US Hwy 23	40.5882	-83.0801	462.8091
38	Bucyrus	Ottawa	Primary	I- 80	41.4745	-83.3337	35
39	Bucyrus	Ottawa	Secondary	State Rte 105 / Water St	41.5081	-83.1554	476
40	Bucyrus	Ottawa	Secondary	SR-53 / NE Catawba Rd	41.5298	-82.8578	476
41	Bucyrus	Richland	Primary	I- 71	40.6485	-82.5457	81.5
42	Bucyrus	Richland	Primary	I- 71	40.6907	-82.5183	81.5
43	Bucyrus	Richland	Secondary	SR-97 / Cleveland St	40.5946	-82.3514	1428
44	Bucyrus	Richland	Secondary	SR-430 / Park Ave W	40.7596	-82.5747	1438.273
45	Bucyrus	Richland	Municipal	W 6th St	40.7653	-82.5227	12818.55
46	Bucyrus	Sandusky	Primary	I- 80	41.3936	-83.0797	174
47	Bucyrus	Sandusky	Secondary	US-6 / Main St	41.3413	-83.2967	659
48	Bucyrus	Sandusky	Secondary	US-20 Bypass Hwy	41.3612	-83.0835	659
49	Bucyrus	Seneca	Secondary	SR-67 / S Kilbourne St	41.1192	-83.0217	630.2294
50	Bucyrus	Seneca	Secondary	US Hwy 224	41.1088	-83.2214	624.5
51	Cleveland	Ashland	Primary	I- 71	40.8678	-82.2398	60
52	Cleveland	Ashland	Primary	I- 71	40.8421	-82.2815	60.52174
53	Cleveland	Ashland	Secondary	US Hwy 42	40.9419	-82.1532	1162
54	Cleveland	Ashland	Secondary	State Rte 58	41.0343	-82.2220	1170.544
55	Cleveland	Cuyahoga	Primary	I- 71	41.4602	-81.6945	535.5
56	Cleveland	Cuyahoga	Primary	I- 490	41.4789	-81.6729	535.5

Site #	OHSP Region	County	Segment Type	Road to be Observed	Latitude	Longitude	Sampling Weight
57	Cleveland	Cuyahoga	Secondary	US-42 / Pearl Rd	41.3828	-81.7783	2054.5
58	Cleveland	Cuyahoga	Secondary	SR-283 / Lakeshore Blvd	41.5975	-81.5463	2054.5
59	Cleveland	Cuyahoga	Municipal	E 80th St	41.4601	-81.6321	21509
60	Cleveland	Cuyahoga	Municipal	E 49th St	41.4633	-81.6572	21509
61	Cleveland	Lorain	Primary	I- 80	41.3448	-82.3369	151
62	Cleveland	Lorain	Primary	I- 90	41.3893	-82.1659	151
63	Cleveland	Lorain	Secondary	OH-83 / Avon Belden Rd	41.2025	-82.0239	988
64	Cleveland	Lorain	Secondary	SR-18 / W Herrick Ave	41.1686	-82.2183	988
65	Cleveland	Lorain	Municipal	E River St	41.3678	-82.0971	15148
66	Cleveland	Medina	Primary	I- 76	41.0318	-81.7932	76.5
67	Cleveland	Medina	Primary	I- 271	41.1621	-81.7855	76.5
68	Cleveland	Medina	Secondary	SR-301 / Spencer Rd	41.0825	-82.1236	567.5
69	Cleveland	Medina	Secondary	SR-261 / Akron Rd	41.0429	-81.6978	567.5
70	Cleveland	Medina	Municipal	Crystalbrooke Dr	41.2598	-81.7535	7776
71	Cleveland	Stark	Primary	I- 77	40.7731	-81.3875	95
72	Cleveland	Stark	Primary	I- 77	40.8680	-81.4301	95
73	Cleveland	Stark	Secondary	SR-43 / Market Ave N	40.8357	-81.3658	1539.5
74	Cleveland	Stark	Secondary	SR-93 / Manchester Ave NW	40.8076	-81.6018	1539.5
75	Cleveland	Stark	Municipal	Elton St SW	40.7264	-81.5541	30770
76	Cleveland	Summit	Primary	I- 271	41.2289	-81.6274	461
77	Cleveland	Summit	Primary	I- 271	41.3359	-81.5149	461
78	Cleveland	Summit	Secondary	SR-91 / Darrow Rd	41.2817	-81.4405	1135
79	Cleveland	Summit	Secondary	SR-261 / West Ave	41.1016	-81.4493	1135
80	Cleveland	Summit	Municipal	Belleflower Rd	41.0714	-81.5547	14616
81	Cleveland	Summit	Municipal	Stratford St	41.0016	-81.6349	14616
82	Cleveland	Wayne	Primary	I- 71	40.9834	-82.0392	21
83	Cleveland	Wayne	Primary	I- 71	40.9598	-82.0627	21.53165
84	Cleveland	Wayne	Secondary	SR-301 / Elyria Rd	40.8994	-82.1085	1040
85	Cleveland	Wayne	Secondary	US-30 / Lincoln Way	40.7898	-81.9337	1048.387
86	Warren	Ashtabula	Primary	I- 90	41.9167	-80.5687	196
87	Warren	Ashtabula	Primary	I- 90	41.7683	-80.9820	196
88	Warren	Ashtabula	Secondary	SR-531 / 9th St	41.8811	-80.8575	898.5
89	Warren	Ashtabula	Secondary	SR-534 / S Broadway St	41.7725	-80.9466	898.5
90	Warren	Columbiana	Secondary	State Rte 45	40.8925	-80.8806	1460
91	Warren	Columbiana	Secondary	State Rte 45	40.7942	-80.7800	1460
92	Warren	Geauga	Secondary	US Hwy 422	41.3841	-81.2316	361.5
93	Warren	Geauga	Secondary	SR-306 / Chillicothe Rd	41.4695	-81.3400	361.5
94	Warren	Geauga	Municipal	Lake Ave	41.4559	-81.0808	4271
95	Warren	Lake	Primary	I- 90	41.6019	-81.4400	189.5
96	Warren	Lake	Primary	I- 90	41.6734	-81.2398	189.5
97	Warren	Lake	Secondary	SR-91 / Som Center Rd	41.6013	-81.4399	841.5
98	Warren	Lake	Secondary	US-20 / Euclid Ave	41.6132	-81.4649	841.5
99	Warren	Lake	Municipal	Driftwood Dr	41.7150	-81.3594	9723
100	Warren	Mahoning	Primary	I- 680	41.1225	-80.7158	290.5
101	Warren	Mahoning	Primary	I- 680	41.0908	-80.6507	290.5
102	Warren	Mahoning	Secondary	SR-45 / S Salem Warren Rd	41.0510	-80.8572	1062.5
103	Warren	Mahoning	Secondary	SR-289 / Wilson Ave	41.0863	-80.6225	1062.5
104	Warren	Mahoning	Municipal	Struthers Rd	40.9986	-80.5615	14952
105	Warren	Portage	Primary	I- 76	41.1055	-81.1205	125.5
106	Warren	Portage	Primary	I- 76	41.1104	-81.2525	125.5
107	Warren	Portage	Secondary	US-224 / Akron Canfield Rd	41.0309	-81.3082	1293
108	Warren	Portage	Secondary	SR-43 / Cleveland Canton Rd	41.2393	-81.3455	1293
109	Warren	Portage	Municipal	Eberly Rd	41.0217	-81.2050	12107
110	Warren	Trumbull	Primary	I- 80	41.1699	-80.5922	251
111	Warren	Trumbull	Primary	I- 80	41.1601	-80.6404	251
112	Warren	Trumbull	Secondary	SR-193 / Belmont Ave	41.1971	-80.6640	949.5
113	Warren	Trumbull	Secondary	State Rte 11	41.3681	-80.6992	949.5
114	Warren	Trumbull	Municipal	Belmont Ave	41.1715	-80.7519	12157
115	Piqua	Auglaize	Primary	I- 75	40.5250	-84.1696	43.5
116	Piqua	Auglaize	Primary	I- 75	40.5576	-84.1701	43.5
117	Piqua	Auglaize	Secondary	State Rte 116	40.6789	-84.4255	843
118	Piqua	Auglaize	Secondary	State Rte 219 / E Spring St	40.4962	-84.2919	843

Site #	OHSP Region	County	Segment Type	Road to be Observed	Latitude	Longitude	Sampling Weight
119	Piqua	Clark	Primary	I- 70	39.9331	-83.6190	120
120	Piqua	Clark	Primary	I- 70	39.8923	-83.8163	120
121	Piqua	Clark	Secondary	SR-41 / Troy Rd / W 1st St	39.9444	-83.8514	626.5
122	Piqua	Clark	Secondary	E National Rd	39.9235	-83.7075	626.5
123	Piqua	Clark	Municipal	W Cassilly St	39.9354	-83.8107	9028
124	Piqua	Darke	Secondary	State Rte 49A	40.0025	-84.5525	1253
125	Piqua	Darke	Secondary	SR-121 / S Center St	40.2189	-84.4843	1253
126	Piqua	Greene	Primary	I- 675	39.8180	-84.0003	104.5
127	Piqua	Greene	Primary	I- 675	39.7754	-84.0224	104.5
128	Piqua	Greene	Secondary	US-42 / S Church St	39.6803	-83.9364	554
129	Piqua	Greene	Secondary	US Hwy 35	39.7089	-84.0285	554
130	Piqua	Greene	Municipal	Wilmington-Dayton Pike	39.5951	-84.1032	11412
131	Piqua	Logan	Secondary	State Rte 366	40.4828	-83.9141	771.5
132	Piqua	Logan	Secondary	State Rte 274	40.4527	-83.7494	771.5
133	Piqua	Miami	Primary	I- 75	40.1370	-84.2166	81.5
134	Piqua	Miami	Primary	I- 75	40.1035	-84.2268	81.5
135	Piqua	Miami	Secondary	SR-66 / Broadway St / Riverside Dr	40.1625	-84.2531	731.5
136	Piqua	Miami	Secondary	US-40 / W National Rd	39.8996	-84.1137	731.5
137	Piqua	Miami	Municipal	W Kessler-Cowlesville Rd	39.9808	-84.2270	8273
138	Piqua	Montgomery	Primary	I- 70	39.8654	-84.0540	207
139	Piqua	Montgomery	Primary	I- 70	39.8383	-84.4652	207
140	Piqua	Montgomery	Secondary	US Hwy 35	39.7524	-84.1895	908.5
141	Piqua	Montgomery	Secondary	SR-48 / Main St	39.8389	-84.2584	908.5
142	Piqua	Montgomery	Municipal	Kenosha Rd	39.6899	-84.1539	16278.5
143	Piqua	Montgomery	Municipal	Orchard Dr	39.7082	-84.1536	16278.5
144	Piqua	Preble	Primary	I- 70	39.8356	-84.6466	44
145	Piqua	Preble	Primary	I- 70	39.8363	-84.5805	44
146	Piqua	Preble	Secondary	State Rte 725	39.6261	-84.7490	783.5
147	Piqua	Preble	Secondary	US Hwy 127	39.6559	-84.6350	783.5
148	Columbus	Delaware	Primary	I- 71	40.2010	-82.9329	43.55844
149	Columbus	Delaware	Primary	I- 71	40.2373	-82.9282	43
150	Columbus	Delaware	Secondary	US Rte 36	40.3027	-83.1135	698.7862
151	Columbus	Delaware	Secondary	US Rte 36	40.2667	-82.9301	694
153	Columbus	Delaware	Municipal	Seldom Seen Rd (Co Rd 121)	40.1698	-83.0823	10167
154	Columbus	Fairfield	Primary	I- 70	39.9350	-82.7844	17.25758
155	Columbus	Fairfield	Primary	I- 70	39.9360	-82.7802	17
156	Columbus	Fairfield	Secondary	SR-204 / Blacklick Eastern Rd NW	39.9272	-82.6836	719.5
157	Columbus	Fairfield	Secondary	SR-37 / Granville Pike	39.7387	-82.5882	736.2326
158	Columbus	Fairfield	Municipal	Market St	39.8001	-82.7047	10985
159	Columbus	Franklin	Primary	I- 270	40.1097	-83.0763	905.3032
160	Columbus	Franklin	Primary	I- 70	39.9624	-83.0516	899.5
161	Columbus	Franklin	Secondary	US-33 / Riverside Dr	40.0686	-83.1053	1666.5
162	Columbus	Franklin	Secondary	US-23 / Summit St	39.9797	-83.0007	1666.5
163	Columbus	Franklin	Municipal	Westrock Dr	40.0068	-83.1741	30732.95
164	Columbus	Franklin	Municipal	Cunard Rd	39.9432	-82.9025	29336
165	Columbus	Knox	Secondary	SR-205 / Danville Jelloway Rd	40.4534	-82.2599	1399.5
166	Columbus	Knox	Secondary	US-36 / Columbus Rd / Main St	40.2952	-82.7080	1399.5
167	Columbus	Licking	Primary	I- 70	39.9438	-82.4083	111.2727
168	Columbus	Licking	Primary	I- 70	39.9479	-82.6682	111.3371
169	Columbus	Licking	Secondary	SR-37/Main St/Johnstown-Alexandria Rd	40.1383	-82.6701	1685.152
170	Columbus	Licking	Secondary	US-62 / Johnstown-Utica Rd NW	40.1806	-82.6273	1686.774
171	Columbus	Licking	Municipal	York Rd SW	39.9334	-82.6296	18077.44
172	Columbus	Madison	Primary	I- 70	39.9564	-83.3728	53
173	Columbus	Madison	Primary	I- 71	39.7464	-83.3280	53
174	Columbus	Madison	Secondary	US-40 / National Pike	39.9331	-83.4882	480.9375
175	Columbus	Madison	Secondary	SR-142 / Columbus Cincinnati Rd	39.9263	-83.3268	472.5
176	Columbus	Madison	Municipal	E 5th St	39.8895	-83.4479	2974.829
177	Columbus	Morrow	Primary	I- 71	40.3624	-82.8459	50.91736
178	Columbus	Morrow	Primary	I- 71	40.3750	-82.8281	50.5
179	Columbus	Morrow	Secondary	State Rte 61	40.6646	-82.8217	364.681
180	Columbus	Morrow	Secondary	SR-314 / Chesterville-Shelby	40.5252	-82.6658	362.4396
181	Columbus	Morrow	Municipal	West Point-Bellville Rd	40.6397	-82.8050	3281

Site #	OHSP Region	County	Segment Type	Road to be Observed	Latitude	Longitude	Sampling Weight
182	Columbus	Perry	Secondary	SR-155 / Main St	39.6024	-82.0918	617.5
183	Columbus	Perry	Secondary	State Rte 13	39.8905	-82.4058	617.5
184	Columbus	Perry	Municipal	Town Hwy 54	39.8378	-82.2248	5198
185	Columbus	Pickaway	Secondary	US-23 / Walnut St	39.7086	-82.9872	405
186	Columbus	Pickaway	Secondary	SR-56 / E Main St	39.6015	-82.9437	408.3197
187	Columbus	Pickaway	Municipal	S Main St	39.5467	-83.2533	3674
188	Cambridge	Belmont	Primary	I- 70	40.0703	-80.9067	118.5
189	Cambridge	Belmont	Primary	I- 70	40.0714	-80.7407	118.5
190	Cambridge	Belmont	Secondary	US-40 / E Main St	40.0814	-80.8962	1327
191	Cambridge	Belmont	Secondary	State Rte 7	39.9658	-80.7478	1327
192	Cambridge	Belmont	Municipal	E South St	39.9499	-80.7803	11184
193	Cambridge	Muskingum	Primary	I- 70	39.9502	-81.9561	63.5
194	Cambridge	Muskingum	Primary	I- 70	39.9461	-82.1312	63.5
195	Cambridge	Muskingum	Secondary	Chandlersville Rd	39.9269	-81.9587	696.5
196	Cambridge	Muskingum	Secondary	S River Rd	39.7878	-81.9043	696.5
197	Cambridge	Tuscarawas	Primary	I- 77	40.6471	-81.4509	69.5
198	Cambridge	Tuscarawas	Primary	I- 77	40.2391	-81.5522	69.5
199	Cambridge	Tuscarawas	Secondary	State Rte 212	40.5590	-81.3315	879.5
200	Cambridge	Tuscarawas	Secondary	US Rte 250	40.6416	-81.5800	879.5
201	Wilmington	Brown	Secondary	State Rte 756	38.8592	-84.0325	788.5
202	Wilmington	Brown	Secondary	State Rte 774	38.9902	-83.9359	788.5
203	Wilmington	Brown	Municipal	Purdy Rd / S Main St	38.9840	-83.8109	7553.674
204	Wilmington	Butler	Primary	I- 75	39.3507	-84.3771	45.06024
205	Wilmington	Butler	Primary	I- 75	39.3695	-84.3661	44
206	Wilmington	Butler	Secondary	Michael A Fox Hwy	39.3775	-84.4034	891
207	Wilmington	Butler	Secondary	Cincinnati Brookville Rd	39.3108	-84.6921	900.9
208	Wilmington	Butler	Municipal	Kyles Station Rd	39.4160	-84.4078	18531.84
209	Wilmington	Clermont	Primary	I- 275	39.1673	-84.2676	36
210	Wilmington	Clermont	Primary	I- 275	39.1015	-84.2842	36.29032
211	Wilmington	Clermont	Secondary	US Hwy 50	39.1210	-84.1870	753.5
212	Wilmington	Clermont	Secondary	State Rte 276	39.1116	-84.1343	753.5
213	Wilmington	Clermont	Municipal	State Rte 727	39.2101	-84.0884	9915
214	Wilmington	Clinton	Primary	I- 71	39.5075	-83.8792	37.5
215	Wilmington	Clinton	Primary	I- 71	39.4627	-83.9845	37.5
216	Wilmington	Clinton	Secondary	State Rte 28	39.3228	-83.7224	545
217	Wilmington	Clinton	Secondary	State Rte 380	39.5014	-83.9397	545
218	Wilmington	Hamilton	Primary	I- 275	39.2744	-84.3556	376
219	Wilmington	Hamilton	Primary	I- 275	39.2503	-84.3094	376
220	Wilmington	Hamilton	Secondary	Montgomery Rd	39.1506	-84.4639	1208.005
221	Wilmington	Hamilton	Secondary	Central Pkwy	39.1112	-84.5205	1196.5
222	Wilmington	Hamilton	Municipal	Delhi Ave	39.0946	-84.6144	16667
223	Wilmington	Hamilton	Municipal	US 50 / Lawrenceburg Rd	39.2288	-84.7998	16667
224	Wilmington	Warren	Primary	I- 75	39.4924	-84.3241	157.5
225	Wilmington	Warren	Primary	I- 71	39.4148	-84.1230	157.5
226	Wilmington	Warren	Secondary	Mill St	39.3557	-84.1281	743
227	Wilmington	Warren	Secondary	W Main St	39.4348	-84.2302	751.4432
228	Wilmington	Warren	Municipal	Greentree Rd / Co Hwy 20	39.4604	-84.2623	12694
229	Jackson	Athens	Secondary	E Bentbrook Dr	39.2877	-82.1373	918
230	Jackson	Athens	Secondary	S Plains Rd	39.3659	-82.1312	918
231	Jackson	Ross	Secondary	US Rte 23	39.3808	-82.9688	661
232	Jackson	Ross	Secondary	US Rte 50	39.2784	-82.8310	661
233	Jackson	Scioto	Secondary	US Hwy 23	38.8017	-82.9839	834.5

Appendix B: Ohio Average Passenger Vehicle Crash-Related Fatalities by County 2010-2014

County	Average Fatalities	Percent of State Fatalities Within County	Cumulative Percent
Franklin	79.2	7.6	7.6
Cuyahoga	54.8	5.2	12.8
Montgomery	47.8	4.6	17.4
Hamilton	45.0	4.3	21.7
Lucas	36.6	3.5	25.2
Stark	33.8	3.2	28.4
Summit	31.0	3.0	31.4
Butler	25.2	2.4	33.8
Trumbull	24.0	2.3	36.1
Mahoning	22.8	2.2	38.3
Clermont	21.4	2.0	40.3
Lorain	20.2	1.9	42.2
Licking	18.4	1.8	44.0
Wood	17.0	1.6	45.6
Ashtabula	15.4	1.5	50.2
Warren	16.0	1.5	48.7
Clark	16.0	1.5	47.2
Columbiana	13.2	1.3	54.0
Wayne	13.4	1.3	52.7
Ross	13.4	1.3	51.4
Medina	12.4	1.2	60.0
Lake	12.4	1.2	58.8
Delaware	12.6	1.2	57.7
Fairfield	12.8	1.2	56.5
Portage	13.0	1.2	55.2
Richland	11.0	1.1	64.5
Pickaway	11.6	1.1	63.4
Scioto	12.0	1.1	62.3
Muskingum	12.0	1.1	61.2
Marion	10.0	1.0	65.4
Greene	9.2	0.9	69.1
Miami	9.4	0.9	68.2
Logan	9.4	0.9	67.3
Fulton	9.8	0.9	66.4
Sandusky	8.0	0.8	77.9
Athens	8.0	0.8	76.4
Seneca	8.4	0.8	75.6
Erie	8.4	0.8	74.8
Ashland	8.4	0.8	74.0
Tuscarawas	8.6	0.8	73.2
Ottawa	8.6	0.8	72.4
Darke	8.6	0.8	71.6
Geauga	8.8	0.8	70.7
Belmont	8.8	0.8	69.9
Mercer	8.0	0.8	77.1
Madison	7.2	0.7	84.3
Huron	7.2	0.7	83.6
Hancock	7.2	0.7	82.9
Auglaize	7.2	0.7	81.5
Preble	7.4	0.7	80.8
Allen	7.6	0.7	80.1

County	Average Fatalities	Percent of State Fatalities Within County	Cumulative Percent
Clinton	7.8	0.7	78.7
Guernsey	7.2	0.7	82.2
Pike	7.8	0.7	79.4
Crawford	6.0	0.6	88.5
Knox	6.2	0.6	87.3
Morrow	6.6	0.6	84.9
Union	5.8	0.6	89.6
Williams	6.0	0.6	89.1
Lawrence	6.2	0.6	87.9
Coshocton	6.2	0.6	86.7
Washington	6.4	0.6	86.2
Shelby	6.6	0.6	85.5
Brown	4.8	0.5	94.1
Defiance	5.4	0.5	91.7
Holmes	4.8	0.5	94.6
Adams	4.8	0.5	93.7
Harrison	5.0	0.5	93.2
Fayette	5.0	0.5	92.7
Jackson	5.4	0.5	92.3
Wyandot	5.5	0.5	91.2
Highland	5.6	0.5	90.7
Hardin	5.6	0.5	90.2
Perry	4.6	0.4	95.9
Vinton	3.8	0.4	98.6
Paulding	3.8	0.4	98.2
Meigs	3.8	0.4	97.8
Van wert	4.0	0.4	97.5
Jefferson	4.0	0.4	97.1
Carroll	4.0	0.4	96.7
Putnam	4.3	0.4	96.3
Henry	4.6	0.4	95.5
Champaign	4.6	0.4	95.0
Noble	3.2	0.3	99.8
Hocking	3.2	0.3	99.5
Morgan	3.3	0.3	99.2
Monroe	3.3	0.3	98.9
Gallia	2.2	0.2	100.0

Appendix C: Population of Road Types by County and Number Selected

County	Population of Primary Segments	Number of Primary Segments Sampled	Population of Secondary Segments	Number of Secondary Segments Sampled	Population of Local Segments	Number of Local Segments Sampled	Total Population of Segments	Total Number of Segments Sampled
Allen	157	2	1,689	2	18,829	1	20,675	5
Ashland	114	2	2,138	2	13,890	0	16,142	4
Ashtabula	163	2	1,940	2	9,321	0	11,424	4
Athens	0	0	1,720	2	8,259	0	9,979	2
Auglaize	78	2	1,655	2	11,362	0	13,095	4
Belmont	294	2	2,132	2	16,905	1	19,331	5
Brown	0	0	1,602	2	10,068	1	11,670	3
Butler	87	2	1,733	2	19,470	1	21,290	5
Clark	217	2	1,235	2	9,563	1	11,015	5
Clermont	119	2	1,563	2	10,564	1	12,246	5
Clinton	65	2	1,141	2	4,152	0	5,358	4
Columbiana	0	0	2,430	2	16,064	0	18,494	2
Crawford	0	0	1,196	2	7,289	0	8,485	2
Cuyahoga	1,808	2	5,068	2	46,547	2	53,423	6
Darke	0	0	2,387	2	17,746	0	20,133	2
Defiance	0	0	1,655	2	11,332	0	12,987	2
Delaware	84	2	1,227	2	10,479	1	11,790	5
Erie	130	2	1,446	2	6,996	0	8,572	4
Fairfield	30	2	1,317	2	12,602	1	13,949	5
Franklin	1,778	2	3,442	2	60,020	2	65,240	6
Fulton	142	2	1,293	2	11,161	1	12,596	5
Geauga	0	0	714	2	4,272	1	4,986	3
Greene	184	2	1,122	2	13,475	1	14,781	5
Hamilton	1,175	2	2,386	2	33,483	2	37,044	6
Hancock	167	2	1,174	2	7,615	0	8,956	4
Huron	0	0	2,238	2	12,310	0	14,548	2
Knox	0	0	2,668	2	23,430	0	26,098	2
Lake	275	2	1,762	2	10,750	1	12,787	5
Licking	217	2	2,919	2	33,467	1	36,603	5
Logan	0	0	1,321	2	6,041	0	7,362	2
Lorain	278	2	1,996	2	16,268	1	18,542	5
Lucas	608	2	1,846	2	22,158	2	24,612	6
Madison	105	2	882	2	3,338	1	4,325	5
Mahoning	544	2	2,049	2	15,202	1	17,795	5
Marion	0	0	1,022	2	4,407	0	5,429	2
Medina	259	2	1,166	2	7,666	1	9,091	5
Miami	156	2	1,374	2	8,765	1	10,295	5
Montgomery	600	2	1,788	2	35,058	2	37,446	6
Morrow	99	2	677	2	3,619	1	4,395	5
Muskingum	203	2	1,459	2	9,599	0	11,261	4
Ottawa	33	1	948	2	6,434	0	7,415	3
Perry	0	0	1,123	2	5,198	1	6,321	3
Pickaway	11	0	818	2	3,687	1	4,516	3
Portage	243	2	2,211	2	19,995	1	22,449	5
Preble	85	2	1,449	2	9,583	0	11,117	4

County	Population of Primary Segments	Number of Primary Segments Sampled	Population of Secondary Segments	Number of Secondary Segments Sampled	Population of Local Segments	Number of Local Segments Sampled	Total Population of Segments	Total Number of Segments Sampled
Richland	156	2	2,615	2	21,902	1	24,673	5
Ross	0	0	1,516	2	9,283	0	10,799	2
Sandusky	166	1	1,275	2	6,553	0	7,994	3
Scioto	0	0	1,540	2	10,875	0	12,415	2
Seneca	0	0	1,276	2	6,604	0	7,880	2
Stark	191	2	2,828	2	31,684	1	34,703	5
Summit	906	2	2,215	2	30,966	2	34,087	6
Trumbull	206	2	2,149	2	13,859	1	16,214	5
Tuscarawas	252	2	1,956	2	20,314	0	22,522	4
Warren	293	2	1,293	2	13,217	1	14,803	5
Wayne	39	2	1,950	2	11,360	0	13,349	4
Wood	436	2	1,767	2	11,532	1	13,735	5
Actual Number to be Observed		80		114		39		237

Appendix D: Ohio Seat Belt Survey – Site Description Form

Statewide Seat Belt Survey - Site Description Form 2015
Observer Name

Road to be Observed: _____

Direction of Observation: _____

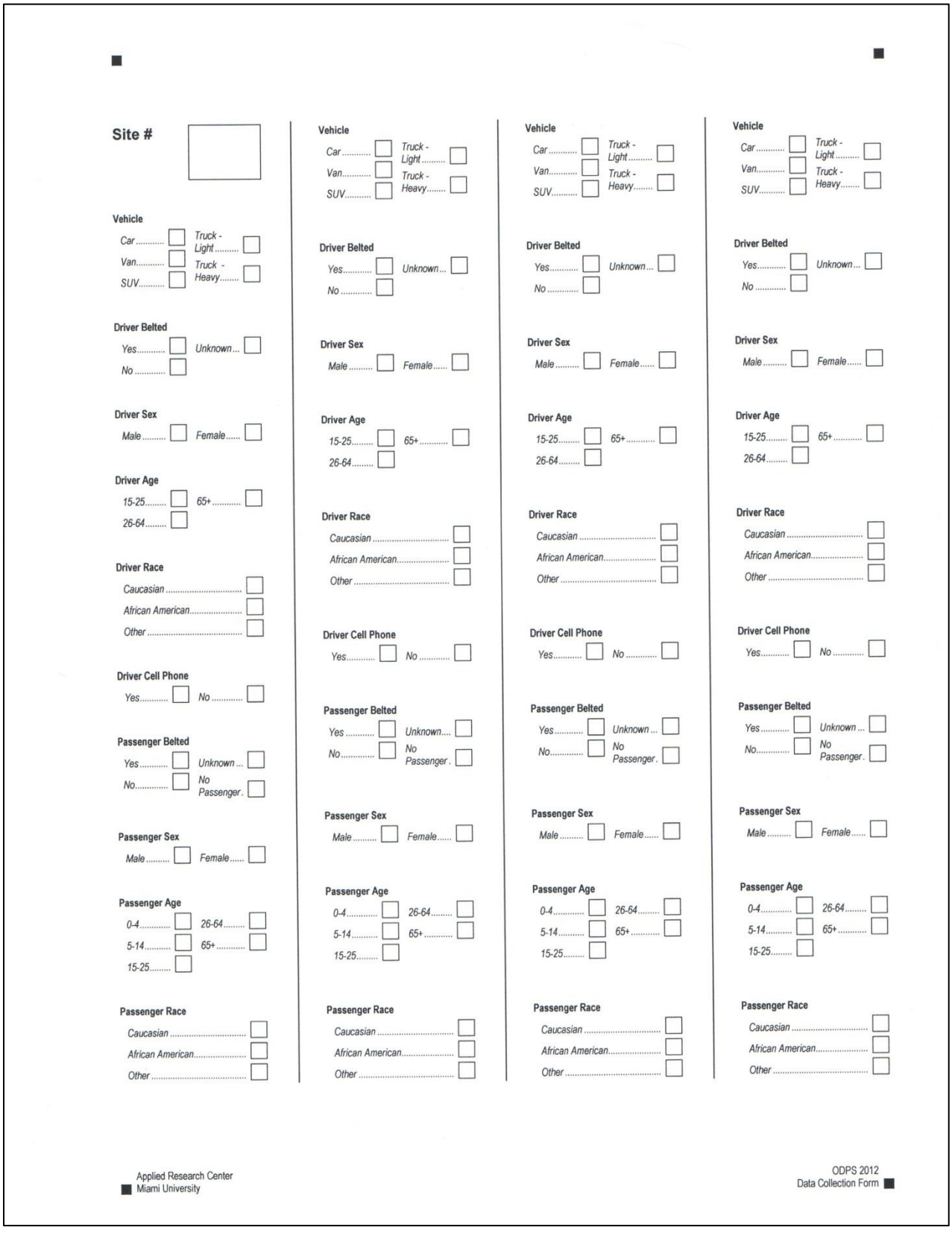
Cross Street: _____

County:	Nearest City:	OSP District:
Site:	Day:	Date:
Start Time:	End Time:	Interuptions:
1st Traffic Count:	2nd Traffic Count:	Total Lanes:

Weather	Visibility	Site	Site Type
___ Sunny/Mostly Sunny	___ Poor	___ Primary	___ Intersection
___ Cloudy/Mostly Cloudy	___ Satisfactory	___ Alternate	___ Freeway Ramp
___ Light Rain	___ Excellent	___ Other	___ Toll
___ Heavy Rain			
___ Snow			

Observer Comments: _____

OHIO SEAT BELT SURVEY – OBSERVATION FORM



Site #

Vehicle
Car ☐ Truck - Light ☐
Van ☐ Truck - Heavy ☐
SUV ☐

Driver Belted
Yes ☐ Unknown ☐
No ☐

Driver Sex
Male ☐ Female ☐

Driver Age
15-25 ☐ 65+ ☐
26-64 ☐

Driver Race
Caucasian ☐
African American ☐
Other ☐

Driver Cell Phone
Yes ☐ No ☐

Passenger Belted
Yes ☐ Unknown ☐
No ☐ No Passenger ☐

Passenger Sex
Male ☐ Female ☐

Passenger Age
0-4 ☐ 26-64 ☐
5-14 ☐ 65+ ☐
15-25 ☐

Passenger Race
Caucasian ☐
African American ☐
Other ☐

Applied Research Center
Miami University

ODPS 2012
Data Collection Form