Observational Survey of Seat Belt Use in Ohio

2018

Final Report

Prepared for:

Ohio Department of Public Safety

John R. Kasich, Governor

John Born, Director

OBSERVATIONAL SURVEY OF SEAT BELT USE IN OHIO - 2018

Prepared for:

Ohio Department of Public Safety
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This project is a demonstration of each agencies ongoing efforts to reduce traffic fatalities by increasing seat belt use. This work has a real, lasting impact on driver and passenger safety throughout the state of Ohio. The research team is honored to have the opportunity to work with a group of individuals that have such a passion for the work they do, and the chance to increase Ohioan safety in such a dramatic manner.

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CHAPTER I – INTRODUCTION

The purpose of this study is to help the National Highway Traffic Safety Administration (NHTSA) and the Ohio Department of Public Safety (DPS) obtain standardized restraint use information for the state of Ohio. This study is also designed to help NHTSA and DPS determine the effectiveness of the annual national Click It or Ticket (CIOT) campaign, which was accomplished by performing seat belt surveys before and after the campaign. Furthermore, the results allow NHTSA and DPS to identify the geographic regions, vehicle types and occupant demographics related to low and high compliance rates. With this information, NHTSA and DPS may provide more targeted public information campaigns and law enforcement initiatives to increase restraint use and help save lives throughout Ohio.

The procedures outlined in this document were developed in compliance with federal requirements and in conjunction with both NHTSA and DPS to ensure state to state comparability. The success of this study is dependent on the quality of data gathered.

This report is broken into four chapters. In addition to the four chapter, appendices are included at the end of the report detailing supplementary information. The chapters are outlined below:

- Chapter I – Introduction: This chapter introduces the study scope and purpose. In addition, this chapter outlines the organization of the report.
- Chapter II – Methodology: This chapter defines the methodology and statistical analysis that was developed and used to obtain, process and present the studies data.
- Chapter III – Results: This chapter presents the data that was collected in a detailed manner.
- Chapter IV – Conclusions & Recommendations: This chapter includes a discussion on the outcomes of the study and specifies key points that may be taken away from the data collected. This chapter also includes recommendations on how Ohio may improve seat belt usage in the future.

The research team believes that the proper use of the study conclusions will ultimately result in an increased seat belt usage rate throughout Ohio. In addition, the team believes that this study is an important tool for NHTSA and DPS to use in analyzing crashes and fatalities.

CHAPTER II – METHODOLOGY

The methodology for this study was derived based upon the NHTSA's "*Uniform Criteria for State Observational Surveys of Seat Belt Use"*, previous Ohio studies, and similar studies from other states. The methodology was approved by NHTSA and is described in detail in the following sections. The research team notes that the methodology used in this year's study is consistent with previous studies conducted in Ohio, allowing for a meaningful comparison of changes in compliance rates over time.

2.1 Sample Selection

2.1.1 Study Timeline

This study was conducted in two separate phases so that NHTSA and DPS would have the ability to assess the efficiency of the national CIOT campaign on improving seat belt compliance rates in Ohio. The first phase was conducted during the two weeks immediately before the CIOT campaign and was used to determine the baseline compliance rate in 2018. The second phase was conducted during the two weeks immediately following the CIOT campaign and was used to determine the post-intervention compliance rate. The dates of the two observations may be found in Table 1.

Table 1: Study Timeline

Start Date	End Date	Task
04/30/2018	05/13/2018	Baseline Observations
05/14/2018	06/03/2018	Click It or Ticket Campaign
06/04/2018	06/17/2018	Post-Intervention Observations

As seen in Table 1, this year's study ran from April 30 to June 17, 2018.

2.1.2 Site Selection

The site locations were selected based the 2010-2014 NHTSA Fatality Analysis Reporting System (FARS). Using the FARS data, the 57 out of the 88 total counties accounted for 85% of the cumulative fatalities within the state during this five year time frame. Following the NHTSA's "*Uniform Criteria for State Observational Surveys of Seat Belt Use"*, these 57 counties represent the sample frame for selection of the survey locations. Figure 1 shows a map of the selected counties.

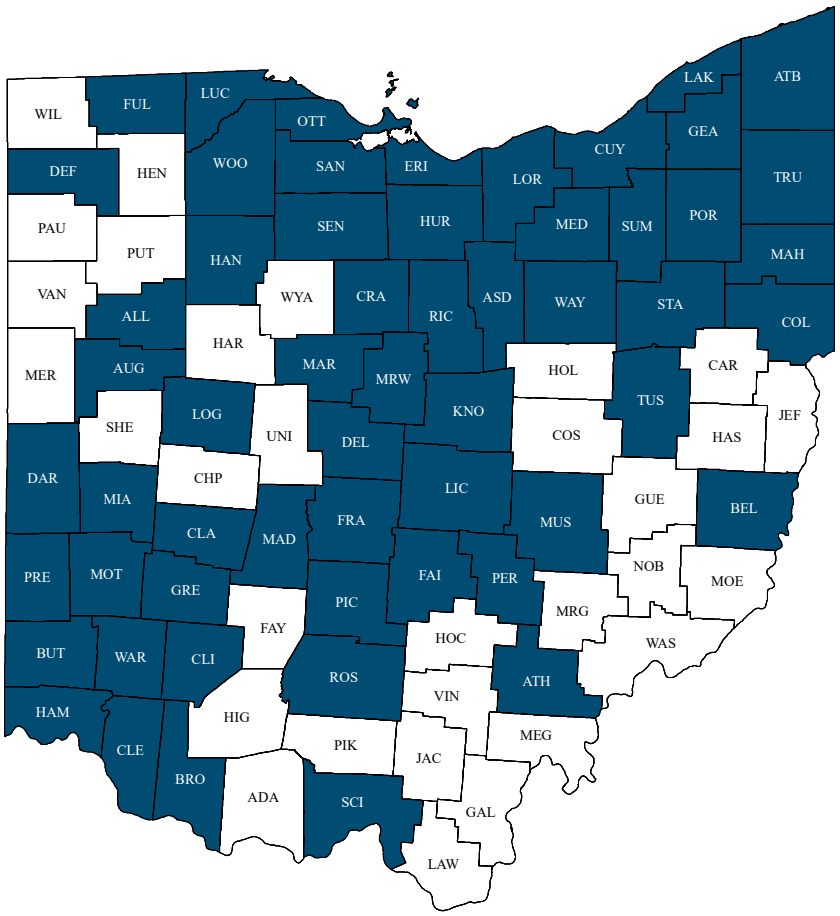
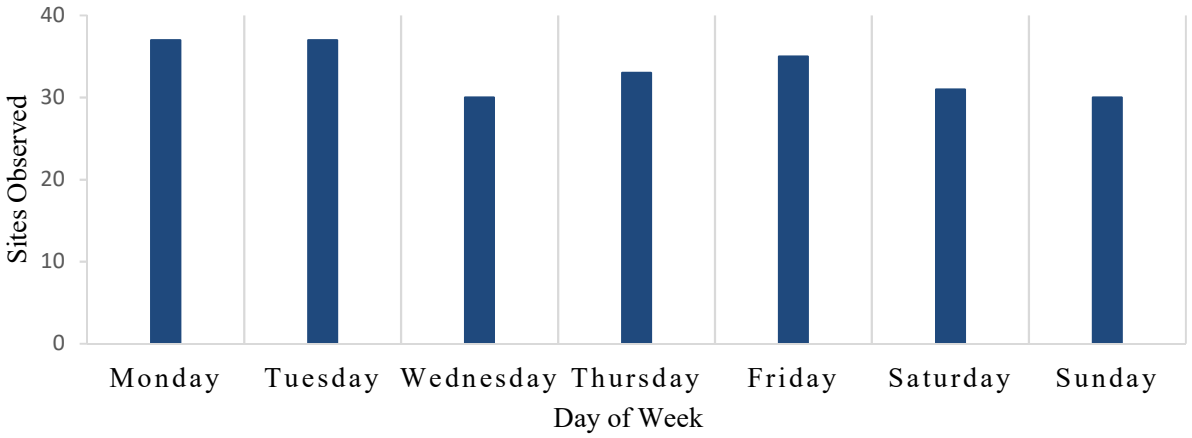


Figure 1: Observed Counties

The site locations within these counties were selected from a random sample of segments and stratified by functional class.

2.1.3 Site Distributions

In order to ensure that the data collected constituted a representative sample, the days and times that were assigned were randomized. The randomized selection was produced using a random number generator in Microsoft Excel. The random numbers were then used to represent different days and start times. Sites that were geographically close to each other were clustered into groups to reduce travel and labor costs. The site groupings were then assigned a day and start time for the first site, with all other sites in the grouping following based on the next closest location. Figure 2 shows the distribution of sites observed per day of the week.

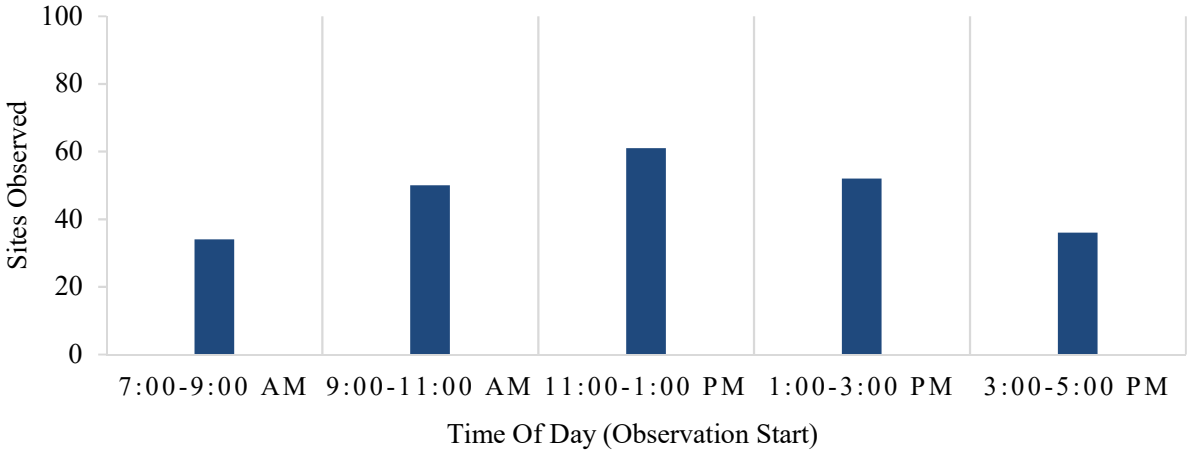


Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
37	37	30	33	35	31	30

Note: Observation days were randomly assigned.

Figure 2: Site Distribution per Day of Week

As seen in Figure 2, the sites observed per day of the week appeared uniform throughout the week. Due to the sites being grouped, some days received an additional group. Figure 3 shows the sites observed per time of day.



7:00-9:00 AM	9:00-11:00 AM	11:00-1:00 PM	1:00-3:00 PM	3:00-5:00 PM
34	50	61	52	36

Note: Observation start times were randomly assigned. Observations were conducted from 7:00 am to 6:00 pm with the last observation starting at 5:00 pm.

Figure 3: Site Distribution per Time of Day

As seen in Figure 3, the mid-day hours received the most sites while the morning and evening hours received the least. Due to the mid-day hours having a higher likelihood of being observed, this time slot has a higher number of sites observed.

2.2 Statistical Analysis

Rates for seat belt use are determined for each individual survey site, as well as at the county and statewide levels. In addition, 95-percent confidence intervals for each use rate estimate are determined. The methods applied in estimating these quantities are based on the approved protocol and are consistent with NHTSA's "*Uniform Criteria for State Observational Surveys of Seat Belt Use"*. Details of the methods used to estimate seat belt use rate and variance are provided in this section.

2.2.1 Imputation

No imputation was done on missing data.

2.2.2 Sampling Weights

The following is a summary of the notation used in this section:

- g – Subscript for county,
- h – Subscript for road segment type,
- i – Subscript for road segment,
- j – Subscript for directional of travel,
- k – Subscript for lane of travel, and
- l – Subscript for vehicle.

Under this stratified multistage sample design, the inclusion probability for each vehicle at a particular site is the product of the selection probabilities at each stage. The overall vehicle inclusion probability at a given site may be found in Equation 1.

$$\pi_{jkl} = \pi_j \, \pi_{k|j} \, \pi_{l|k} \qquad \text{Equation 1}$$

where:

π_j = direction,
$\pi_{k|j}$ = lane of travel, and
$\pi_{l|jk}$ = vehicle.

The sampling weight (design weight) for each vehicle at a particular may be seen in Equation 2.

$$w_{jkl} = \frac{1}{\pi_{jkl}} \qquad \text{Equation 2}$$

where:

w_{jkl} = sampling weight.

At the site-level, the number of segments sampled was small relative to the number of segments in the population for each county-road segment type stratum. Consequently, no finite population correction factors were applied. The sampling weights for each segment are simply equal to the reciprocal of the proportion of segments sampled in each county-road type stratum as displayed in Equation 3.

$$w_{ghi} = \frac{N_{gh}}{n_{gh}} \qquad \text{Equation 3}$$

where:

w_{ghi}= sampling weight for segment *i* of road segment type *h* in county *g*,
n_{gh}= number of segments sampled from road segment type stratum *h* of county *g*, and
N_{ghi} = total number of segments among road segment type stratum *h* of county *g*.

Thus, the overall inclusion probability of an individual vehicle is $\pi_{ghijk} = \pi_{ghi}\pi_{jkl|ghi}$ and the sampling weight is $w_{ghijkl} = w_{ghi}w_{jkl|ghi}$.

2.2.3 Non-Response Adjustment

There are two instances by which non-response may arise with respect to data collection for the seat belt use survey. First, a site may be unobservable due to issues such as the presence of a construction work zone. In these instances, an alternative site is provided and this site may be included without needing to adjust the sampling weights. The data collection protocol in the approved plan also includes provisions for instances where both the primary and alternative observation site are unavailable for observation. However, as this scenario was not encountered, no adjustment for non-responding sites was necessary as a part of the 2018 survey.

Secondly, non-response may arise at the vehicle level in instances where the belt use of vehicle occupants was unobservable due to issues such as glare, tinted windows, etc. In these instances, the sampling weight for that site is increased by multiplying by the reciprocal of the response rate at that site, r_{ghi}. Thus, the sampling weight for each individual site is now defined as shown in Equation 4.

$$w_{ghi} = \frac{N_{gh}}{n_{gh}r_{ghi}} \qquad \text{Equation 4}$$

2.2.4 Estimators

For each front-seat occupant observed, their seat belt use status was defined as seen in Equation 5.

$$y_{jkl|ghi} = \begin{cases} 1, if\ belt\ used \\ 0, otherwise \end{cases} \qquad \text{Equation 5}$$

As such, within an individual observation site *i* of road segment type *h* in county *g*, the seat belt use rate (proportion) is estimated as presented in Equation 6.

$$\hat{p}_{ghi} = \frac{\sum w_{jkl|ghi} y_{jkl|ghi}}{\sum w_{jkl|ghi}} \quad \text{Equation 6}$$

The use rate ($\hat{p}_{gh}$) for road segment type *h* in county *g* is then determined using Equation 7.

$$\hat{p}_{gh} = \frac{\sum w_{ghi} \hat{p}_{ghi}}{\sum w_{ghi}} \quad \text{Equation 7}$$

At the county level, use rates ($\hat{p}_g$) for each road segment type are weighted by stratum-level VMT. Equation 8 demonstrations this calculation.

$$\hat{p}_g = \frac{\sum_{\forall h} VMT_{gh} \hat{p}_{gh}}{\sum_{\forall h} VMT_{gh} \hat{p}_{gh}} \quad \text{Equation 8}$$

where:

VMT_{gh}= total vehicle miles traveled for road segment type *h* in county *g*.

The use of the VMT-based estimator reduces the weighting bias towards local road segments by accounting for their relatively short length and low VMT as compared to primary and secondary roads. Similarly, the statewide use rates ($\hat{p}_{statewide}$) is simply an average of the county-level use rates, weighted by total county-level VMT among the three road segment classes as found in Equation 9.

$$\hat{p}_{statewide} = \frac{\sum_{\forall g} \sum_{\forall h} VMT_{gh} \hat{p}_{gh}}{\sum_{\forall g} \sum_{\forall h} VMT_{gh} \hat{p}_{gh}} \quad \text{Equation 9}$$

2.2.5 Variance Estimation

The variance and standard error for each estimator was determined as detailed in this section. First, at the county-road segment class, the variance is calculated as displayed in Equation 10.

$$V(\hat{p}_{gh}) = \sum_{\forall h}\left[\frac{\left(N_{gh}/N_g\right)^2}{n_{gh}}\sum_{i=1}^{n_{gh}}\frac{(\hat{p}_{ghi}-\hat{p}_{gh})^2}{n_{gh}-1}\right] \quad \text{Equation 10}$$

where:

$V(\hat{p}_{gh})$ = Estimated variance within road segment class *h* of county *g*,
N_{gh}= Total number of road segments of type *h* in county *g,*
N_g= Total number of road segments of all types in county *g,*
n_{gh}= Number of locations sampled among road segment type *h* in county *g,*
$\hat{p}_{ghi}$ = Estimated belt use rate at location *i* in road segment type *h* in belt use group *g,* and
$\hat{p}_g$ = Estimated belt use rate in road segment type *h* in belt use group *g.*

When a road segment stratum includes less than two sites, it is aggregated with the adjacent stratum. For the purposes of this study, all counties included at least two secondary sites. Consequently, this aggregation involved either the local segments being combined with the secondary segments or the primary segments being combined with the secondary segments. From here, the county-level variance is given by Equation 11.

$$V(\hat{p}_g) = \frac{\sum_{\forall h} VMT_{gh}^2 \times V(\hat{p}_{gh})}{\left(\sum_{\forall h} VMT_{gh}\right)^2} \quad \text{Equation 11}$$

Finally, the state-level variance is calculated similarly using Equation 12.

$$V(\hat{p}_{statewide}) = \frac{\sum_{\forall g\forall h} VMT_{gh}^2 \times V(\hat{p}_{gh})}{\left(\sum_{\forall g\forall h} VMT_{gh}\right)^2} \quad \text{Equation 12}$$

For each estimate, the standard error of use rate is found by simply taking the square root of the estimated variance. The 95-percent confidence interval of each use rate is equal to the weighted seat belt use rate plus/minus 1.96 (for the Z-test at alpha = 0.05) multiplied by the standard error.

2.2.6 Non-Response Rate

According to NHTSA's guidelines, the non-response rate for the annual seat belt survey cannot exceed 10%. A non-response occurs when the observer was not able to determine the safety belt use of a front seat vehicle occupant. This may occur due to a variety of reasons such as tinted windows, sun glare, high speeds of the vehicle in question, etc. Observers in the field marked 'unknown belt use' to keep a record of the non-response rate. There were a total of 90 non-response observations which represents approximately 0.37% of the total number of observations. This non-response rate was below the allowable maximum of 10% established by the NHTSA guidelines.

2.3 Data Collection

The nature of this study requires a large amount of data to be collected in a very short period of time. Due to this, NHTSA, DPS, University of Akron (UA) and the observers must operate and communicate clearly. The majority of the work for this study is completed before any observations even begin, preparing, organizing and distributing material need for the study.

2.3.1 Observer Training

The success of this study is completely dependent on the quality of data that is recorded. Due to this, it is critical that the observers are trained in a thorough and complete manner on how to properly record the data. A mandatory training session was organized and led by the UA principal investigator at DPS headquarters in Columbus, Ohio the week before the first phase of observations were to start. Any observers that were not able to attend the training meeting were trained separately with UA.

2.3.2 Vehicle Classification

This study is built to differentiate seat belt use between five different vehicle classes. These include: passenger car (PC), sport utility vehicle (SUV), van/minivan (V), light truck (LT) and heavy truck (HT) up to a gross vehicle weight rating (GVWR) of 10,000 pounds or less. Light trucks includes vehicles with an estimated GVWR less and 6,000 pounds and include light-duty pickup trucks. Heavy trucks includes vehicles with an estimated GVWR of 6,001-10,000 pounds and include full-size pickup trucks, utility vans and step vans; however, does not include walk-in trucks or delivery trucks.

2.3.3 Field Procedure

The field data collection procedure was communicated to the observers through the mandatory training session and a set of printed instructions. For each site, the observer prepared him/herself by reviewing the imagery provided for each site. Once at the site, the observer found a safe place to setup and collected a five-minute traffic count. After completion of the traffic count, the observer collected seat belt observation data for the next 50 minutes. Finally, a second five-minute traffic count was performed, after which the observer departed the site. The forms used to collect data may be found in Appendix A. Figure 4 shows observers during site observations.

(a) (b) (c)

(a) Bellville, Ohio Site; (b) Twinsburg, Ohio Site; (c) Churchill, Ohio Site.

Figure 4: Observer Site Visits

As seen in Figure 4, the observers conducted site observations in a safe area near the study site. Random, unannounced site visits to each observer were performed by the research team to ensure that each observer was performing their observations correctly. A total of 16 site visits were conducted for a total sample of 6.9% of the sites, more than the 5% recommended by NHTSA's "*Uniform Criteria for State Observational Surveys of Seat Belt Use"*.

CHAPTER III – RESULTS

This chapter includes the results of the 2018 Ohio Seat Belt Study. Each type of dataset that was collected is broken into an individual section. Each section typically contains a chart and table to visualize the data. There are thirteen sections in this chapter as follows:

- Section 3.1: Statewide Compliance,
- Section 3.2: Historical Compliance,
- Section 3.3: Compliance per District,
- Section 3.4: Compliance per County,
- Section 3.5: Compliance per Day of Week,
- Section 3.6: Compliance per Time of Day,
- Section 3.7: Compliance per Road Class,
- Section 3.8: Compliance per Vehicle Type,
- Section 3.9: Compliance per Gender,
- Section 3.10: Compliance per Age,
- Section 3.11: Compliance per Race,
- Section 3.12: Compliance per Demographics, and
- Section 3.13: Cell Phone Usage.

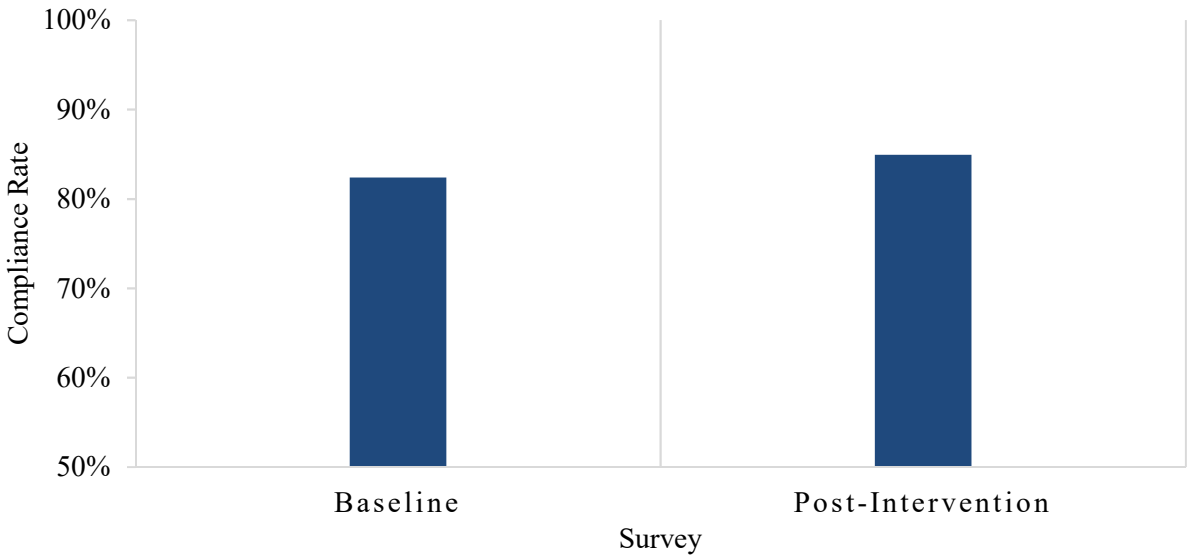
There are a few key terms that the UA team would like to define that will be used throughout this chapter. These key terms include:

- Compliance: The compliance refers to the percentage of observable occupants that were wearing a seat belt.
- Standard Error: The standard error refers to the standard deviation of the compliance rate. A 95-percent confidence interval for each compliance rate can be determined by adding (subtracting) 1.96 times the standard error to (from) the compliance rate.
- Count: The count refers to the total number of observable occupants that data was collected on.

The following sections include more information regarding the results of this year's study.

3.1 Statewide Compliance

The *"Observational Survey of Seat Belt Use in Ohio – 2018"* collected a total of 48,371 occupant observations, including 39,524 vehicles with 8,847 passengers. The reported post-intervention results include 24,462 occupants comprising 19,829 vehicles and 4,633 vehicles. A total of 233 sites across 57 counties were included. Figure 5 shows the statewide compliance results for Ohio in 2018.



Survey	Compliance (%)	Standard Error (%)	Count
Baseline	82.39	0.98	23,909
Post-Intervention	84.92	0.81	24,462
Difference	2.53	N/A	553

Note: Reported numbers are weighted.

Figure 5: Statewide Compliance Rate

As seen in Figure 5, Ohio observed a statewide compliance rate of 84.92%. Additionally, the CIOT campaign had a positive impact on statewide compliance amounting to a 2.53% increase. The statewide results were weighted using the methodology described in Chapter II of this report. The statewide compliance results includes all observations that were made during the post-intervention survey.

The data presented in the statewide compliance rate is the only data for the remainder of this report that includes the baseline (pre-CIOT) data. All data reported after this point is the post-intervention survey (post-CIOT). Additionally, only the statewide and historical compliance results are weighted, all other reported numbers are unweighted.

3.2 Historical Compliance

In previous studies, Ohio has traditionally trailed behind the national average compliance rate. Since 1998, Ohio has averaged a compliance rate that is 3.23% lower than the national average. The 2018 compliance rate in Ohio (84.90%) is 4.80% lower than the national average (89.70%) in 2017. Figure 6 shows the comparison between the Ohio and national compliance rates.

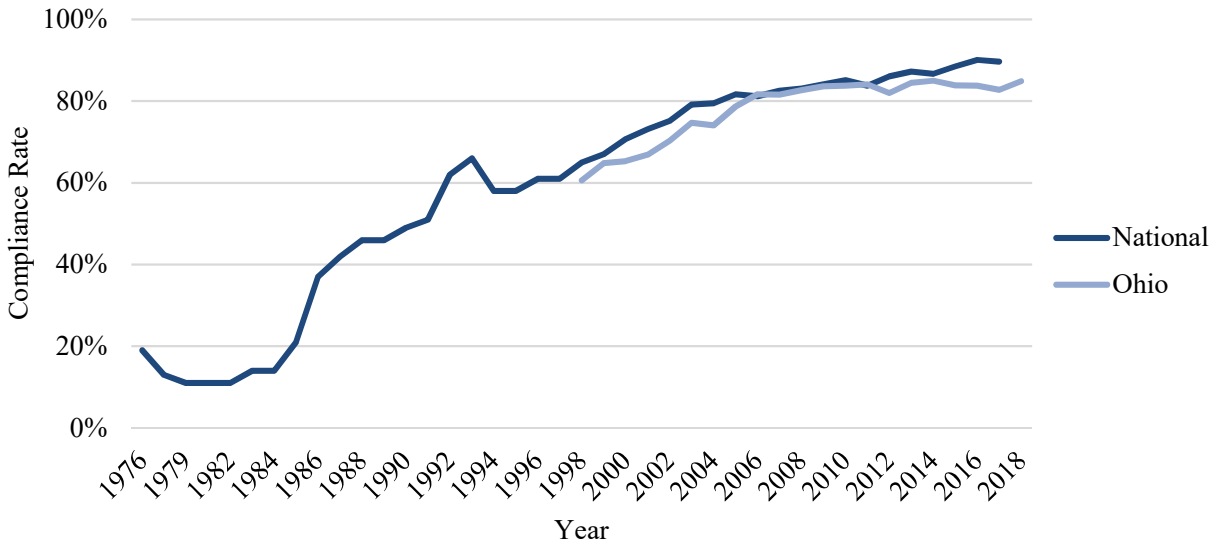
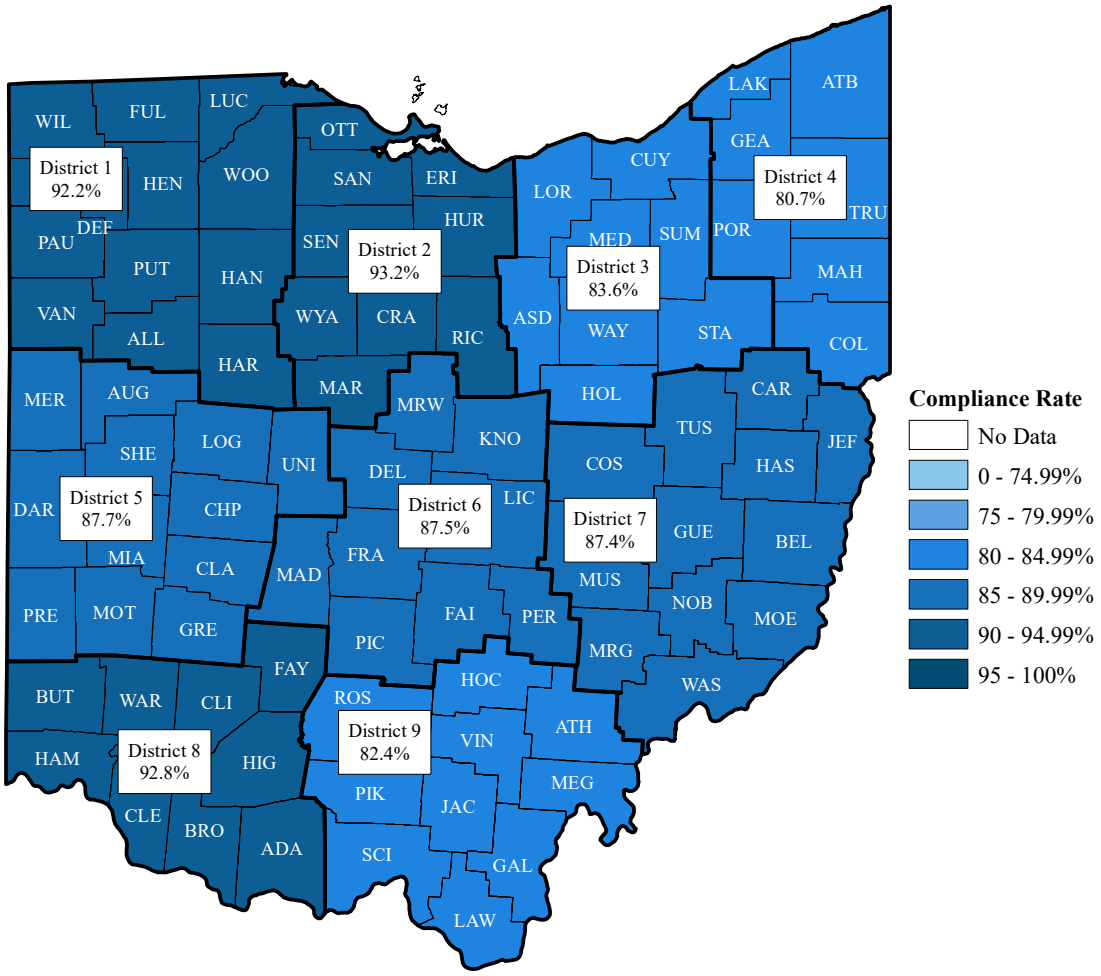


Figure 6: Historical Compliance Rate

National data for 2018 has not been released at the time of writing; however, data from 1976 through 2017 are included. Data from Ohio from 1998 through 2018 are included. Results from the 2018 Ohio study are consistent with previous year's studies. For the past decade, the compliance rate in Ohio has remained relatively unchanged, varying between 82.0% and 85.0%.

3.3 Compliance per District

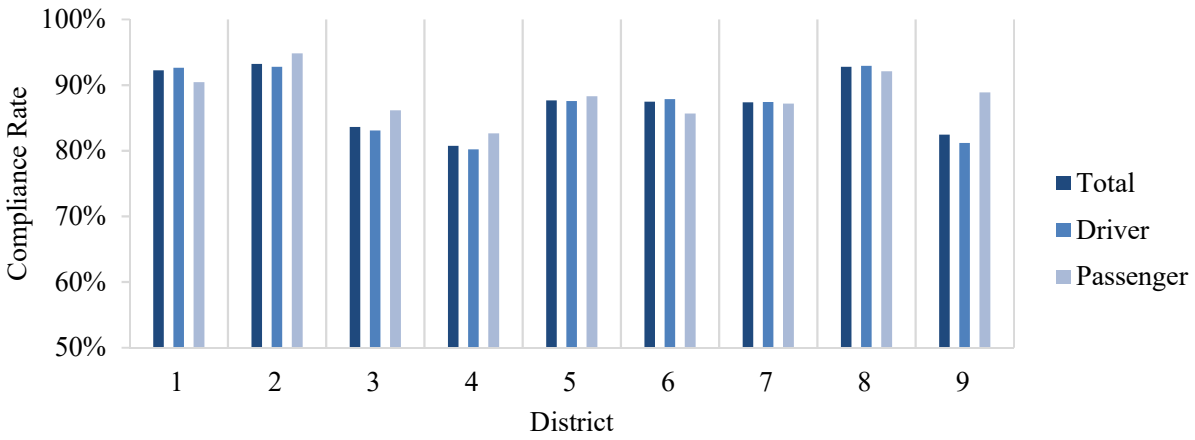
The observations were grouped into each of the nine OSHP districts in which they were located. This allowed for the data to be viewed on a broad level to determine if certain geographical regions presented low or high compliance. Figure 7 shows a map of each district with its corresponding compliance rate.



Note: Reported numbers are unweighted.

Figure 7: Compliance Rate per District Map

As seen in Figure 7, Districts 3, 83.6%, 4, 80.7%, and 9, 82.4%, had the lowest compliance rates. District 3 includes the cities of Cleveland, Akron and Canton along with Interstates I-76, I-77, I-271, I-480 and I-90. The majority of District 3 includes highly populated areas, with some rural counties on the perimeter of the district. District 4 includes much of Northeast Ohio in addition to the cities of Youngstown and Warren. Interstates I-76, I-80 and I-90 run through District 4 as well. District 9 includes rural southern Ohio and is the only district that does not include an Interstate route. The majority of District 9 is sparsely populated with the exception of Athens, Ohio. Figure 8, gives more details on the results of the District compliance rates.



District	Occupant	Compliance (%)	Sample Size
1	All	92.2	2,940
	Driver	92.6	2,417
	Passenger	90.4	523
2	All	93.2	2,952
	Driver	92.8	2,294
	Passenger	94.8	658
3	All	83.6	4,618
	Driver	83.1	3,830
	Passenger	86.2	788
4	All	80.7	3,409
	Driver	80.2	2,690
	Passenger	82.6	719
5	All	87.7	2,150
	Driver	87.5	1,766
	Passenger	88.3	384
6	All	87.5	3,906
	Driver	87.8	3,208
	Passenger	85.7	698
7	All	87.4	1,567
	Driver	87.4	1,224
	Passenger	87.2	343
8	All	92.8	2,379
	Driver	92.9	1,949
	Passenger	92.1	430
9	All	82.4	541
	Driver	81.2	451
	Passenger	88.9	90

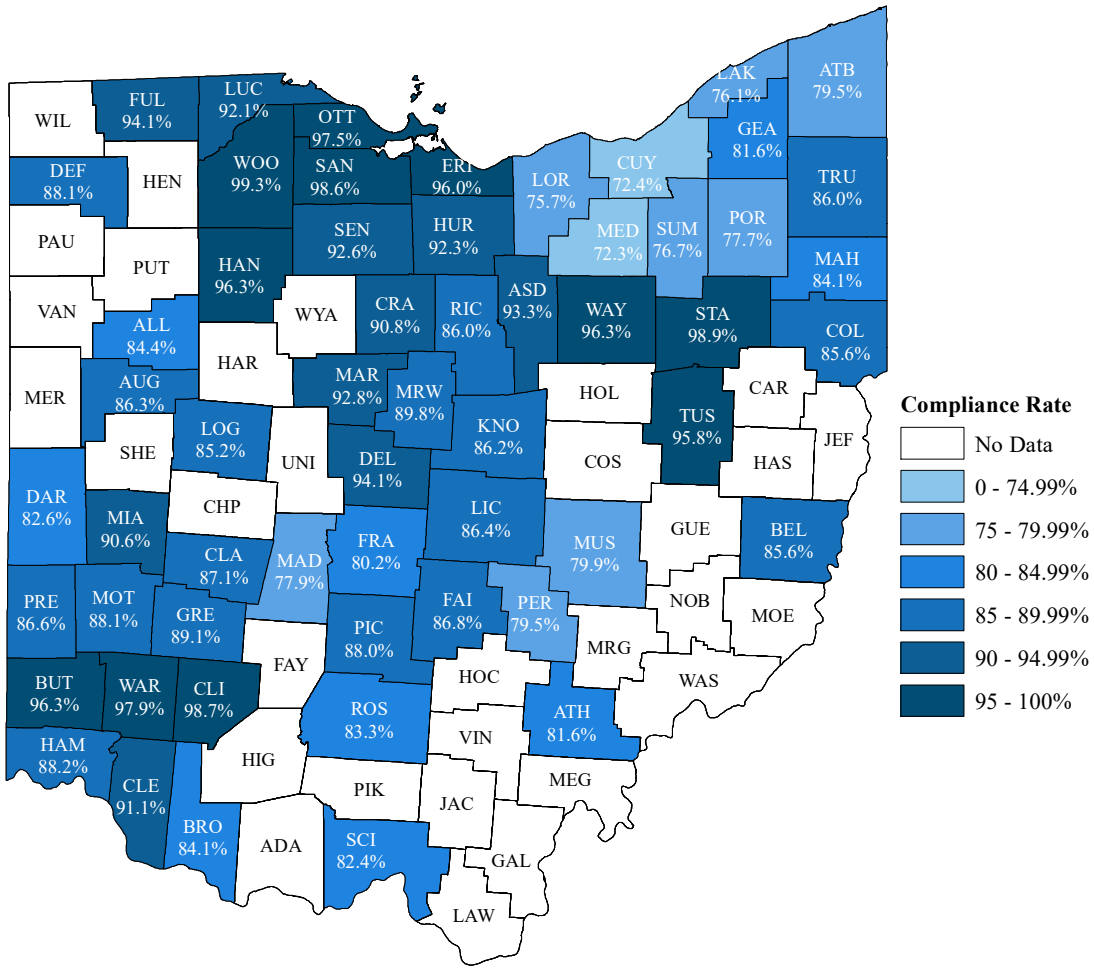
Note: District refers to OSHP, refer to Figure 7 for locations. Reported numbers are unweighted.

Figure 8: Compliance Rate per District

As seen in Figure 8, District 9, 541, had significantly fewer observations than the other districts, for which between 1,567 and 4,618 observations were obtained. The greatest number of observations occurred in District 3, 4,618.

3.4 Compliance per County

The observations were further broken down by the county in which they were located. A total of 57 out of the 88 Ohio counties were observed in this study. As mentioned in Chapter II, these 57 counties were selected as they accounted for 85% of traffic fatalities in Ohio. Figure 9 displays the county level compliance rates in 2018.

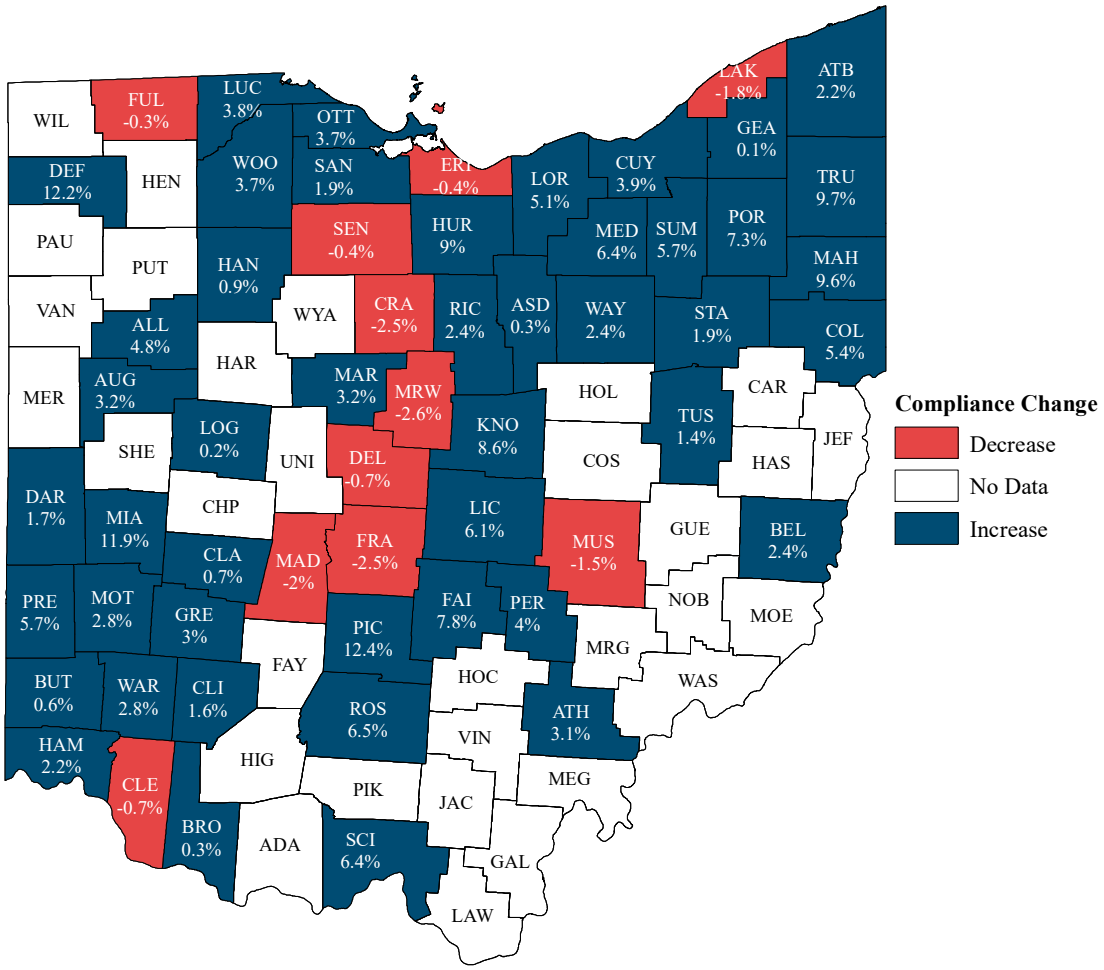


Note: Reported numbers are unweighted.

Figure 9: Compliance Rate per County

As seen in Figure 9, only two counties had a compliance rate lower than 75%, Cuyahoga and Medina. Both of these counties are located in OSHP District 3. Cuyahoga County, home to Cleveland has historically had a very low compliance rate. In contrast, the other two major metropolitan areas in Ohio, Franklin County, Columbus, had a compliance rate of 80.2% and Hamilton County, Cincinnati, had a compliance rate of 88.2%.

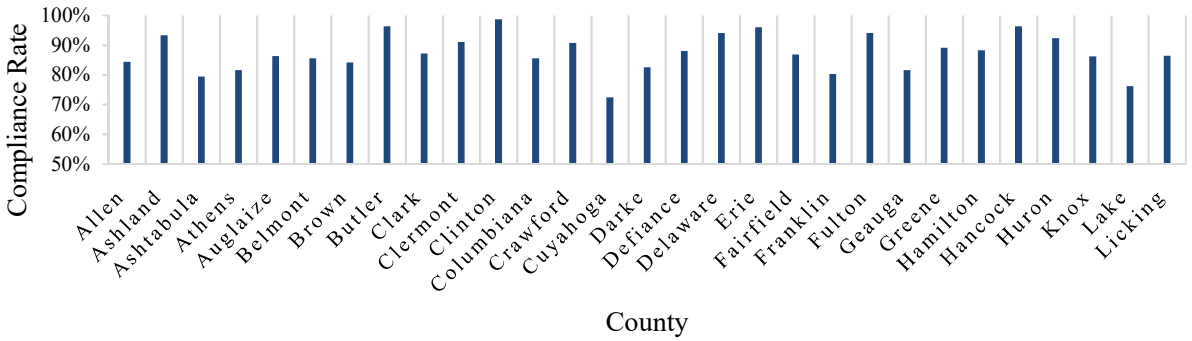
The impact that the national CIOT campaign and enforcement efforts had on the compliance rate was also determined. The difference between the two surveys was calculated using the baseline and post-intervention data. Figure 10 shows a map of the county level CIOT impact.



Note: Reported numbers are unweighted.

Figure 10: Intervention Impact on Compliance Rate per County

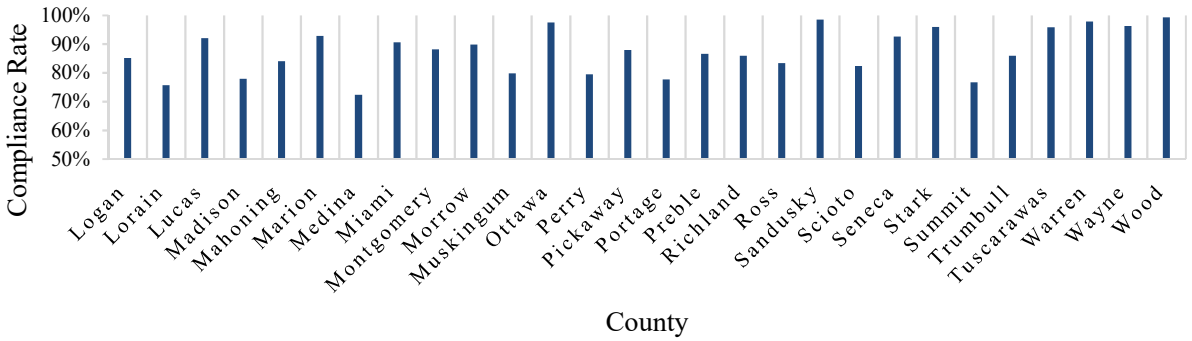
As seen in Figure 10, the CIOT campaign had a positive impact on the majority of counties studied. In total, 46 of the 57 counties increased compliance after CIOT for an average increase of 4.4%. Pickaway County saw the largest increase in compliance at 12.4%. In contrast, 11 counties saw a decrease in compliance after CIOT for an average decrease of -1.4%. The counties which saw a decrease in compliance include Fulton, Erie, Lake, Seneca, Crawford, Morrow, Delaware, Franklin, Madison, Muskingum and Clermont. Morrow County saw the largest decline in compliance after CIOT at -2.6%. The details for each county, including compliance rate and sample size may be found in Figures 11 and 12.



County	Compliance (%)	Sample Size
Allen	84.4	686
Ashland	93.3	599
Ashtabula	79.5	482
Athens	81.6	163
Auglaize	86.3	226
Belmont	85.6	651
Brown	84.1	164
Butler	96.3	433
Clark	87.1	404
Clermont	91.1	527
Clinton	98.7	231
Columbiana	85.6	263
Crawford	90.8	119
Cuyahoga	72.4	807
Darke	82.6	155
Defiance	88.1	134
Delaware	94.1	1,000
Erie	96.0	571
Fairfield	86.8	265
Franklin	80.2	420
Fulton	94.1	355
Geauga	81.6	261
Greene	89.1	341
Hamilton	88.2	603
Hancock	96.3	536
Huron	92.3	246
Knox	86.2	289
Lake	76.1	658
Licking	86.4	352

Note: 29 of 57 observed counties presented in Figure 11, remaining 28 counties presented in Figure 12. Reported numbers are unweighted.

Figure 11: Compliance Rate per County (Allen – Licking)



County	Compliance (%)	Sample Size
Logan	85.2	81
Lorain	75.7	634
Lucas	92.1	769
Madison	77.9	271
Mahoning	84.1	533
Marion	92.8	432
Medina	72.3	495
Miami	90.6	372
Montgomery	88.1	354
Morrow	89.8	708
Muskingum	79.9	412
Ottawa	97.5	441
Perry	79.5	283
Pickaway	88.0	216
Portage	77.7	727
Preble	86.6	217
Richland	86.0	641
Ross	83.3	168
Sandusky	98.6	346
Scioto	82.4	210
Seneca	92.6	258
Stark	95.9	912
Summit	76.7	627
Trumbull	86.0	485
Tuscarawas	95.8	504
Warren	97.9	421
Wayne	96.3	544
Wood	99.3	460

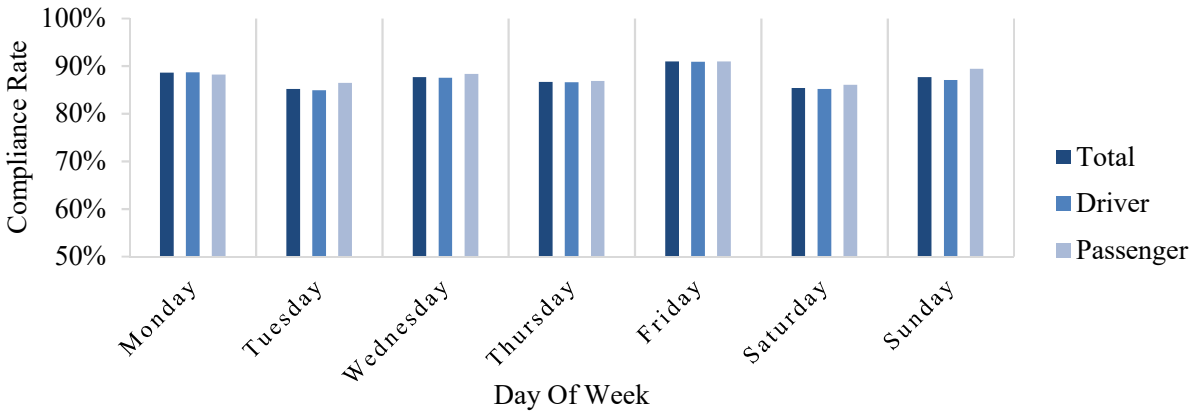
Note: 28 of 57 observed counties presented in Figure 12, remaining 29 counties presented in Figure 11. Reported numbers are unweighted.

Figure 12: Compliance Rate per County (Logan – Wood)

As seen in Figures 11 and 12, county sample sizes ranged from 81 to 1,000 observations. On average, each county accounted for approximately 429

3.5 Compliance per Day of Week

The compliance rate was also calculated by day of week to determine if there was any difference based on day, weekday or weekend. The study was conducted during every day of the week. The results of the compliance rate per day of week may be found in Figure 13.



Day	Occupant	Compliance (%)	Sample Size
Monday	All	88.6	3,821
	Driver	88.7	3,244
	Passenger	88.2	577
Tuesday	All	85.2	3,619
	Driver	84.9	3,000
	Passenger	86.4	619
Wednesday	All	87.7	2,887
	Driver	87.5	2,432
	Passenger	88.4	455
Thursday	All	86.6	3,672
	Driver	86.6	3,110
	Passenger	86.8	562
Friday	All	90.9	3,760
	Driver	90.9	3,062
	Passenger	91.0	698
Saturday	All	85.4	3,363
	Driver	85.2	2,560
	Passenger	86.1	803
Sunday	All	87.7	3,340
	Driver	87.0	2,421
	Passenger	89.4	919

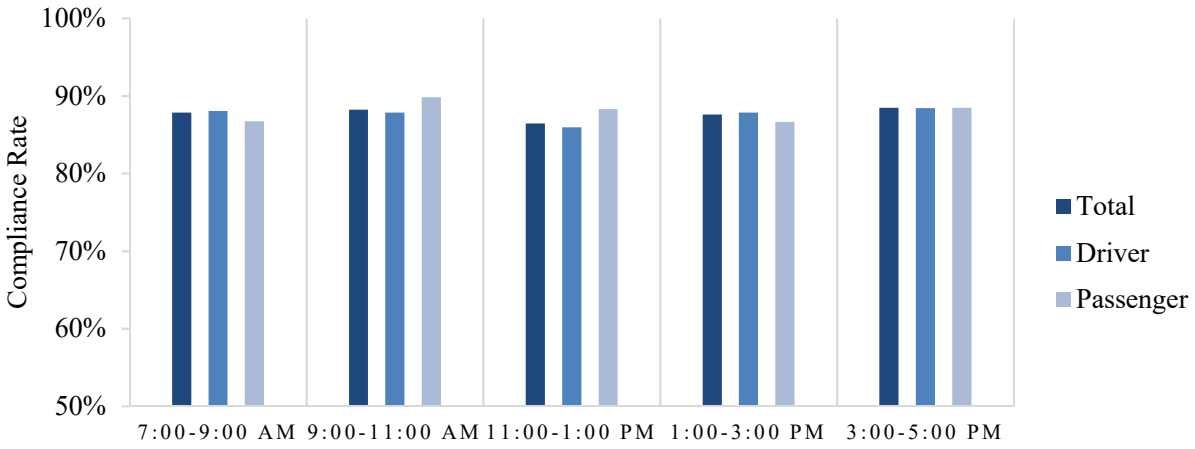
Note: Reported numbers are unweighted.

Figure 13: Compliance Rate per Day of Week

As seen in Figure 13, the day of week has a slight impact on the compliance rate. The day with the highest compliance, Friday, 90.9%, was 5.7% higher than that of the lowest, Tuesday, 85.2%. Additionally, each day of the week had roughly the same number of observations ranging from 2,887 on Wednesday to 3,821 on Monday.

3.6 Compliance per Time of Day

The compliance rate per time of day was considered to conclude if peak travel times had an impact on the compliance rate. The study was conducted from 7:00 AM to 6:00 PM with 5:00 PM being that last time observations would begin. The results of the compliance rate per time of day may be found in Figure 14.



Time (Observation Start)	Occupant	Compliance (%)	Sample Size
7:00-9:00 AM	All	87.8	3,004
	Driver	88.0	2,590
	Passenger	86.7	414
9:00-11:00 AM	All	88.2	5,175
	Driver	87.8	4,270
	Passenger	89.8	905
11:00-1:00 PM	All	86.4	6,339
	Driver	85.9	5,065
	Passenger	88.3	1,274
1:00-3:00 PM	All	87.6	2,825
	Driver	87.8	2,197
	Passenger	86.6	628
3:00-5:00 PM	All	88.4	3,236
	Driver	88.4	2,577
	Passenger	88.5	659

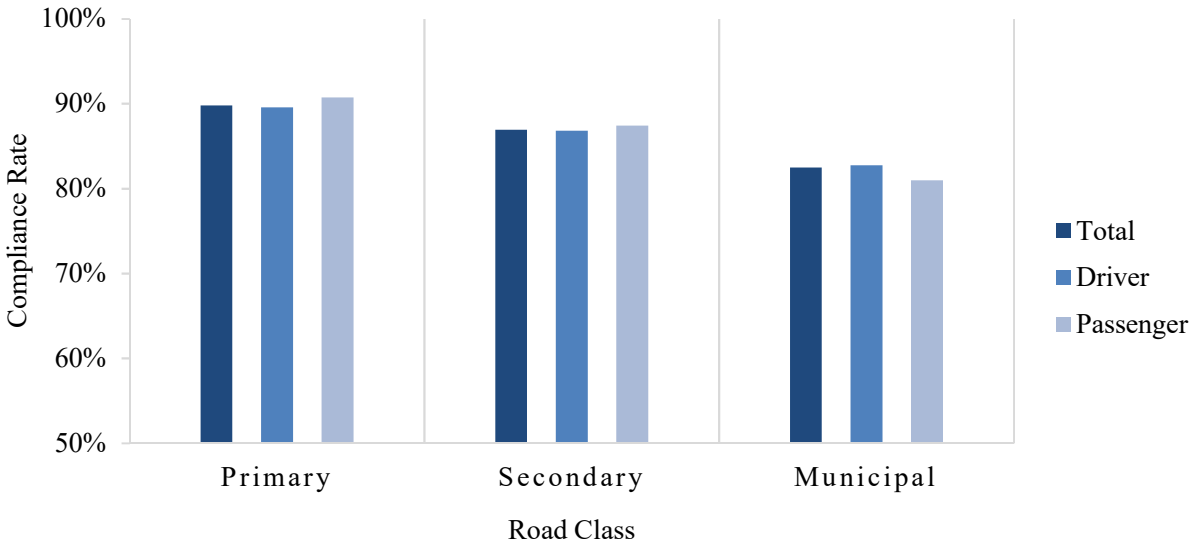
Note: Times refer to time that site observations began, 3:00-5:00 PM includes observations that start at 5:00 PM and are completed at 6:00 PM. Reported numbers are unweighted.

Figure 14: Compliance Rate per Time of Day

As seen in Figure 14, the time of day that the observations were made had little to no impact on the compliance rate of the vehicle occupants. The sample size observed shows that the hours around noon had the most observations which corresponds to that time period have the most sites assigned due to the nature of the scheduling.

3.7 Compliance per Road Class

The compliance rate per road class was determined to see if there was any correlation between type of road and seat belt use. There are three types of road classes based on MAF/TIGER Feature Class Code Definitions (MTFCC), primary, secondary and local. Figure 15 shows the results of the compliance rate per road class.



Road Type	Occupant	Compliance (%)	Sample Size
Primary	All	89.8	8,931
	Driver	89.5	7,126
	Passenger	90.7	18,05
Secondary	All	86.9	12,835
	Driver	86.8	10,448
	Passenger	87.4	2,387
Local	All	82.5	2,696
	Driver	82.7	2,255
	Passenger	81.0	441

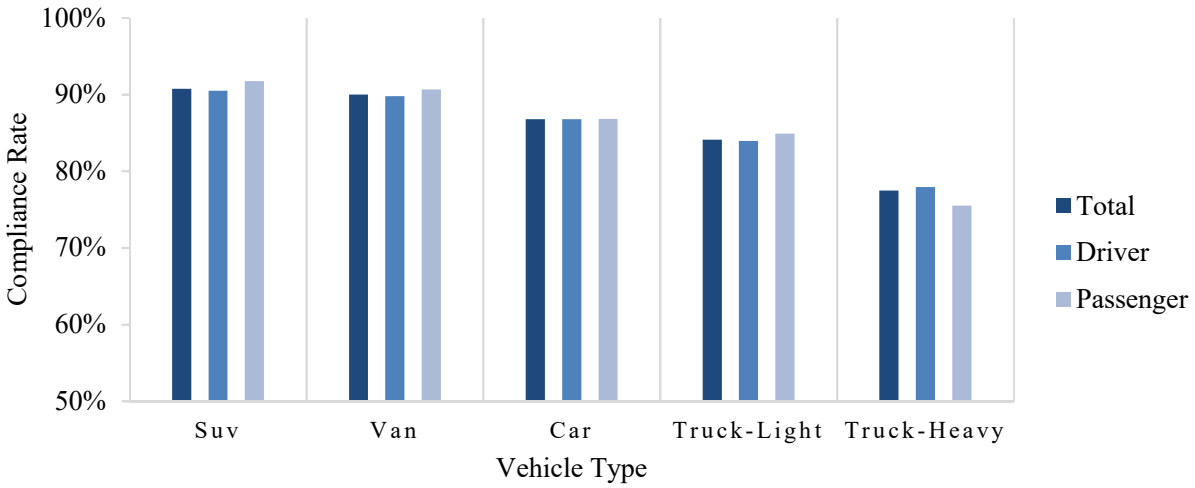
Note: Road classifications were procured using the MAF/TIGER Feature Class Code Definitions. Reported numbers are unweighted. Reported numbers are unweighted.

Figure 15: Compliance Rate per Road Class

As seen in Figure 15, local roads had the lowest compliance rate of any road class at a total of 82.5%. Next, secondary roads, which consist mainly of state and local highways were observed to have a compliance rate of 86.9%. Finally, primary roads, which consist mainly of interstate and limited access highways had the highest compliance rates at 89.8%.

3.8 Compliance per Vehicle Type

The compliance rate per vehicle type was observed to identify if the type of vehicle had an impact on the occupant compliance rate. There were five types of vehicles observed; SUV, Van, Car, Truck-Light and Truck-Heavy. More information on the types of vehicles observe are found in Chapter II of this report. The results of the compliance rate per vehicle type may be found in Figure 16.



Vehicle Type	Occupant	Compliance (%)	Sample Size
SUV	All	90.8	7,541
	Driver	90.5	5,992
	Passenger	91.7	1,549
Van	All	90.0	2,337
	Driver	89.8	1,791
	Passenger	90.7	546
Car	All	86.8	10,397
	Driver	86.8	8,596
	Passenger	86.8	1,801
Truck-Light	All	84.1	2,815
	Driver	84.0	2,331
	Passenger	84.9	484
Truck-Heavy	All	77.5	1,372
	Driver	77.9	1,119
	Passenger	75.5	253

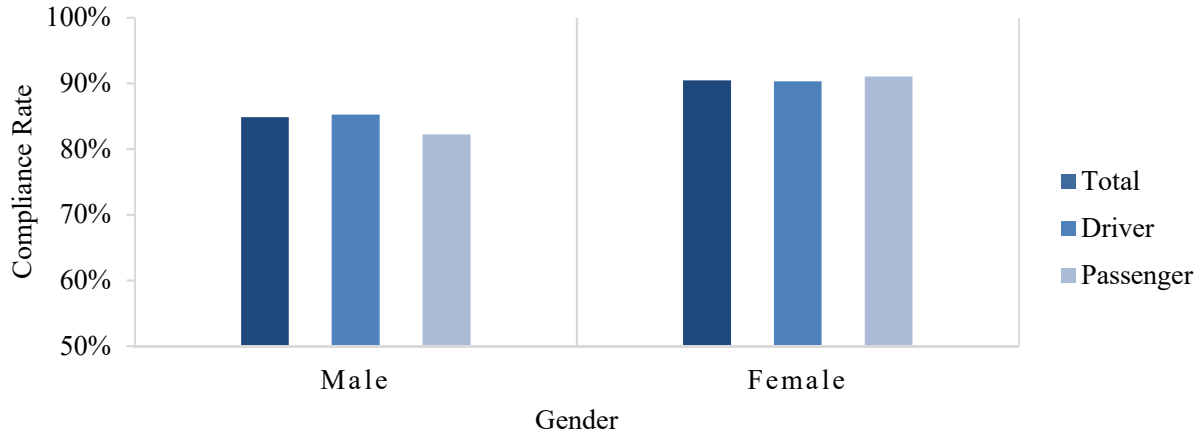
Note: Vehicle information was obtained from the U.S. Department of Energy and Federal Highway Administration. Reported numbers are unweighted.

Figure 16: Compliance Rate per Vehicle Type

As seen in Figure 16, both types of trucks had the lowest compliance rates seen with truck-heavy at 77.5% and truck-light at 84.1%. Next, cars had a compliance rate of 86.8% and vans at 90.0%. The most compliant vehicle type observed was the SUV at 90.8%.

3.9 Compliance per Gender

The compliance rate per gender was obtained to determine if there was a difference in compliance between male and female occupants. Figure 17 shows the results of the compliance rate per gender.



Sex	Occupant	Compliance (%)	Sample Size
Female	All	90.5	11,383
	Driver	90.3	8,283
	Passenger	91.0	3,100
Male	All	84.9	13,079
	Driver	85.2	11,546
	Passenger	82.2	1,533

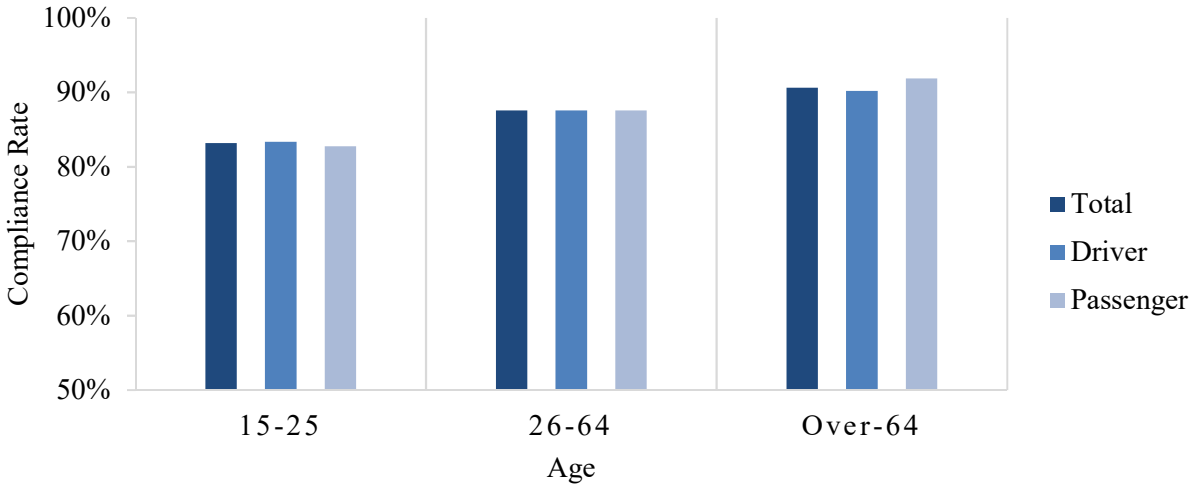
Note: Reported numbers are unweighted.

Figure 17: Compliance Rate per Gender

As seen in Figure 17, the compliance of female occupants is significantly higher than that of males. Female occupants had a compliance rate of 90.5% while males were over 5% less compliant at 84.9%. In addition, it was seen that there were more male than female drivers while there were more female than male passengers.

3.10 Compliance per Age

The compliance rate per age was considered to understand if there is a relationship between occupant age and compliance. Drivers were divided into three age categories; 15-25 years, 26-64 years and over-64 years of age. Additionally, passengers had two additional age groups; 0-4 years and 5-14 years of age. Figure 18 displays the results of the compliance rate per age group.



Age	Occupant	Compliance (%)	Sample Size
0-4	All	100.0	1
	Driver	N/A	0
	Passenger	100.0	1
5-14	All	96.0	326
	Driver	N/A	0
	Passenger	96.0	326
15-25	All	83.2	3,536
	Driver	83.3	2,633
	Passenger	82.7	903
26-64	All	87.5	16,897
	Driver	87.5	14,452
	Passenger	87.6	2,445
Over-64	All	90.6	3,702
	Driver	90.2	2,744
	Passenger	91.9	958

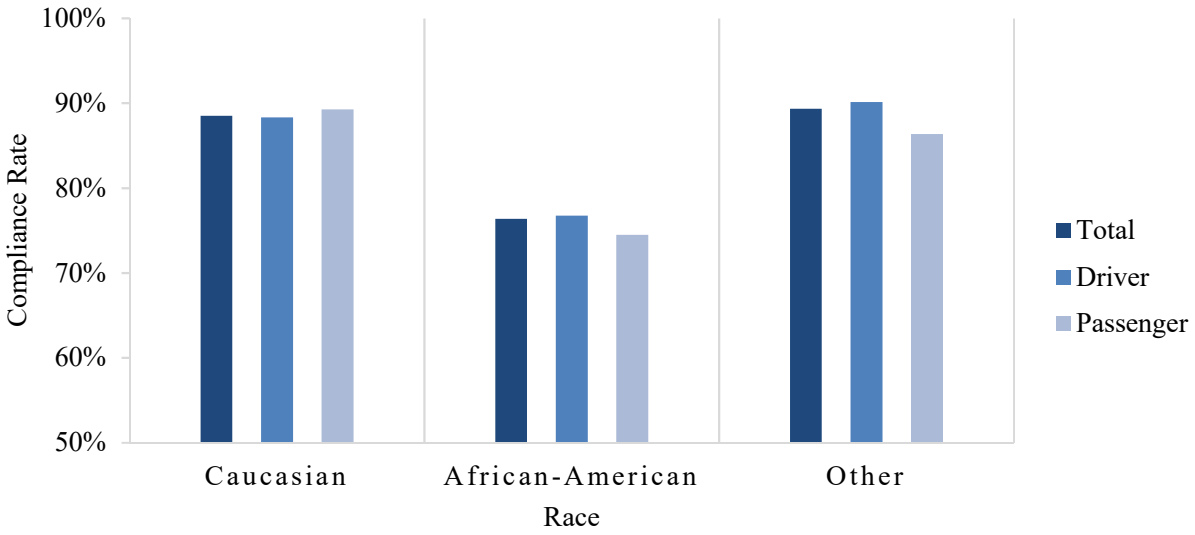
Note: Passengers younger than the age of 15 omitted from graph. Reported numbers are unweighted.

Figure 18: Compliance Rate per Age

As seen in Figure 18, younger occupants had a much lower compliance rate than that of middle-age and older occupants. Occupants aged 15-25 years had the lowest compliance rate at of 83.2%. Occupants aged 26-64 years had a compliance rate of 87.5% and those aged over-64 of 90.6%. Note that occupants under the age of 15 had the highest compliance rate but smallest sample size and may not have control of whether they are belted or not.

3.11 Compliance per Race

The compliance rate per race was observed to see if there was a difference in compliance between races. Occupant race was broken into three categories; Caucasian, African-American and Other. The results of the compliance rate per race may be found in Figure 19.



Race	Occupant	Compliance (%)	Sample Size
Caucasian	All	88.5	22,085
	Driver	88.3	17,863
	Passenger	89.2	4,222
African-American	All	76.4	2,068
	Driver	76.7	1,723
	Passenger	74.5	345
Other	All	89.3	309
	Driver	90.1	243
	Passenger	86.4	66

Note: Reported numbers are unweighted.

Figure 19: Compliance Rate per Race

As seen in Figure 19, both Caucasian and Other occupants had similar compliance rates at 88.5% and 89.3% respectively. African-American occupants had a significantly lower compliance rate at 76.4%. The vast majority of observations made (90.3%) were of Caucasian occupants. In addition, 8.5% of the observations were of African-American occupants while just 1.2% were Other.

3.12 Compliance per Demographics

The compliance rate per demographic characteristics was compiled into a single table to determine which subgroups were most at risk of being noncompliant. In order to keep the sample sizes large enough to be statistically relevant only three demographic factors were looked at; gender, age and vehicle type. Table 2 shows the results of at-risk subgroups.

Table 2: Compliance Rate per Demographics

Gender	Age	Vehicle	Compliance (%)	Sample Size
Male	15-25	Car	78.5	767
		SUV	84.0	219
		Truck-Heavy	75.5	49
		Truck-Light	77.0	174
		Van	86.4	59
	26-64	Car	85.9	3,217
		SUV	88.0	2,050
		Truck-Heavy	76.9	834
		Truck-Light	83.3	1,585
		Van	87.9	752
	Over-64	Car	88.4	770
		SUV	92.8	525
		Truck-Heavy	80.8	125
		Truck-Light	88.3	282
		Van	89.9	138
Female	15-25	Car	88.0	855
		SUV	84.6	409
		Truck-Heavy	100.0	3
		Truck-Light	69.6	23
		Van	92.0	75
	26-64	Car	88.8	2,512
		SUV	93.0	2,470
		Truck-Heavy	85.7	98
		Truck-Light	88.5	244
		Van	91.7	690
	Over-64	Car	90.5	475
		SUV	95.3	319
		Truck-Heavy	60.0	10
		Truck-Light	95.7	23
		Van	90.9	77

Note: Reported numbers are unweighted.

As seen in Table 2, the subgroups that are most at-risk of being noncompliant include most occupants of trucks, especially young and middle-age males. Additionally, young males in cars also were observed to have a low compliance rate. The trends were consistent with those from seat belt surveys conducted in other states, including Michigan. Note that some sample sizes are too small to have statistical relevance.

3.13 Cell Phone Usage

In addition to observing seat belt compliance, data regarding cell phone usage was also collected. An overall statewide estimate of phone use by drivers was determined. Observers were instructed to consider drivers to be using a cell phone if they could clearly be seen talking on it. Table 3 presents the statewide phone usage.

Table 3: Statewide Phone Usage

Phone Use (%)	Sample Size
7.3	19,829

Note: Phone usage applies only to drivers. Reported number is unweighted.

As seen in Table 3, Ohio had a statewide driver phone use rate of 7.3%. Previous studies of seat belt use in Ohio did not report a statewide phone use so there is no historical data to compare to. However, national estimates show a use rate of 5.9% in 2016 (Pickrell & Li, 2017). Consequently, it appears cell phone use by drivers is more prevalent in Ohio as compared to other states. In addition to the statewide phone use, the compliance rate per phone usage was also determined to see if phone users were more or less likely to wear a seat belt. Table 4 shows the compliance rate per phone usage.

Table 4: Compliance Rate per Phone Usage

Phone	Baseline		Post-Intervention	
	Compliance (%)	Sample Size	Compliance (%)	Sample Size
No	84.6	18,285	87.6	18,385
Yes	84.4	1,410	84.6	1,444

Note: Compliance refers to only drivers.

As seen in Table 4, the baseline study saw almost no difference in the compliance rate between phone users and non-phone users. However, in the post-intervention survey, there was a 3.0% increase in compliance for drivers who did not use a phone. Additional investigation is necessary to better understand the relationship between cell phone usage and seat belt compliance.

CHAPTER IV – RECOMMENDATIONS & CONCLUSIONS

The "*Observational Survey of Seat Belt Use in Ohio – 2018"* study provides important insights as to seat belt use among Ohioans. As shown in Chapter III, the CIOT campaign and enforcement successfully increased seat belt usage throughout the state. The compliance rate rose from 82.39% to 84.92% for a net increase of 2.53%. The post-intervention, post-CIOT, seat belt compliance rate increase of 2.53% is similar to what Ohio has seen over the past decade, 2.50% average increase. Overall, the team notes a few trends that were observed in this year's study.

- Local roads have a lower compliance rate compared to primary and secondary roads,
- Heavy and light trucks have a lower compliance rate compared to any other vehicle type,
- Male occupants have a lower compliance rate compared to female occupants,
- Young occupants have a lower compliance rate compared to older occupants, and
- Subgroup of young males in trucks, heavy trucks in particular, showed the lowest compliance rates of all demographic subgroups with an adequate sample size.

When compared to previous studies conducted in Ohio, the conclusions of this year's study are very similar to what has been seen historically throughout the state.

4.1 Recommendations

This year's study provided some additional insights that may be helpful for NHTSA and DPS to recognize as key areas for improvement. These recommendations mirror the trends that were observed in the previous section:

4.1.1 Local Roads

Local roads had by far the lowest rate of compliance in the state. When compared to secondary, 86.9%, and primary, 89.8%, roads, local roads, 82.5%, had on average a 5.9% lower compliance rate. Local roads also service a disproportionately large number of heavy and light trucks, a group in which compliance is also particularly low.

4.1.2 Heavy & Light Trucks

As is consistent with previous studies, heavy trucks, 77.5%, and light trucks, 84.1%, have a significantly lower compliance rate than each; cars, 86.8%, vans, 90.0%, and SUV's, 90.8%. As mentioned in the preceding point, trucks typically are seen in greater numbers on local roads compared to secondary and primary roads. These two groups combine to create a situation that limits the ability to raise the compliance rate for either group significantly.

4.1.3 Male Occupants

When compared to female occupants, 90.5%, male occupants, 84.9%, have historically had a lower compliance rate. Again, as seen in how trucks and local roads combine to depress compliance, so does the male occupants and truck groups. Truck occupants are typically male which creates another grouping that limits the ability to raise the compliance rate.

4.1.2 Young Occupants

Traditionally, young occupants, 83.2%, have a lower compliance rate than both mid-age, 87.5%, and older, 90.6%, occupants. The 2018 study saw no change in this being the case. This group is a prime target for campaigns that attempt to increase seat belt compliance due to the fact that they may be reached in large numbers during driving training and school. The group also has the ability to increase the compliance rate in the future has they will be on the road for the longest amount of time out of any age group.

4.2 Conclusions

Using the information contained in this report, especially the recommendations, both NHTSA and DPS may develop new techniques to increase the seat belt compliance rate in Ohio and nationwide. The use of both enforcement and media campaigns is crucial to maintain the success that Ohio has had and further increase the statewide compliance rate. Each occupant that NHTSA and DPS is able to reach and convince to wear a seat belt has the potential to save a life. Increasing seat belt compliance is one of the easiest ways to decrease the number of annual fatalities that occur on Ohio roads. To that end, the results and recommendations from this study play an important role in helping to achieve this shared goal.

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APPENDIX

Appendix A Data Collection Forms

PHASE:
SITE NUMBER: SITE DESCRIPTION FORM

Observer Information			
1a) Scheduled Observer:		1b) Actual Observer:	
Schedule Information			
2a) Scheduled Day:		2b) Observed Day:	
3a) Scheduled Date:		3b) Observed Date:	
4a) Scheduled Time:		4b) Observed Time:	
Site Information			
5) Site Choice: *If "Alternate" or "Other" complete 6b, 7b, 8b & 9b*	Primary	Alternate	Other
6a) Primary Site Type:		*6b) Alternate Site Type:*	
7a) Primary Site:		*7b) Alternate Site:*	
8a) Primary Direction:		*8b) Alternate Direction:*	
9a) Primary Cross Street:		*9b) Alternate Cross Street:*	
10) OSHP District:			
11) County:			
12) Nearest City:			
Traffic Information			
13) Total Lanes Counted:			
14) Traffic Count #1:			
15) Traffic Count #2:			
Weather Information			
16) Precipitation:	Sunny Cloudy Light Rain Heavy Rain Snow		
17) Visibility:	Excellent Satisfactory Poor		
Additional Information			
18) Interruptions:	_____ minutes; caused by:		
19) Total SSF pages:			
20) Notes:			

Figure 20: Site Description Form

PAGE NUMBER:
SITE NUMBER:

SITE SURVEY FORM

VEHICLE	CAR VAN SUV TRUCK-LIGHT TRUCK-HEAVY	CAR VAN SUV TRUCK-LIGHT TRUCK-HEAVY	CAR VAN SUV TRUCK-LIGHT TRUCK-HEAVY	CAR VAN SUV TRUCK-LIGHT TRUCK-HEAVY	CAR VAN SUV TRUCK-LIGHT TRUCK-HEAVY
DRIVER BELT	YES NO UNKNOWN	YES NO UNKNOWN	YES NO UNKNOWN	YES NO UNKNOWN	YES NO UNKNOWN
DRIVER SEX	MALE FEMALE	MALE FEMALE	MALE FEMALE	MALE FEMALE	MALE FEMALE
DRIVER AGE	15-25 26-64 OVER-64	15-25 26-64 OVER-64	15-25 26-64 OVER-64	15-25 26-64 OVER-64	15-25 26-64 OVER-64
DRIVER RACE	CAUCASIAN AFRICAN-AMERICAN OTHER.	CAUCASIAN AFRICAN-AMERICAN OTHER	CAUCASIAN AFRICAN-AMERICAN OTHER	CAUCASIAN AFRICAN-AMERICAN OTHER	CAUCASIAN AFRICAN-AMERICAN OTHER
DRIVER PHONE	YES NO	YES NO	YES NO	YES NO	YES NO
PASSENGER BELT	YES NO UNKNOWN NO-PASSENGER	YES NO UNKNOWN NO-PASSENGER	YES NO UNKNOWN NO-PASSENGER	YES NO UNKNOWN NO-PASSENGER	YES NO UNKNOWN NO-PASSENGER
PASSENGER SEX	MALE FEMALE	MALE FEMALE	MALE FEMALE	MALE FEMALE	MALE FEMALE
PASSENGER AGE	0-4 5-14 15-25 26-64 OVER-64	0-4 5-14 15-25 26-64 OVER-64	0-4 5-14 15-25 26-64 OVER-64	0-4 5-14 15-25 26-64 OVER-64	0-4 5-14 15-25 26-64 OVER-64
PASSENGER RACE	CAUCASIAN AFRICAN-AMERICAN OTHER	CAUCASIAN AFRICAN-AMERICAN OTHER	CAUCASIAN AFRICAN-AMERICAN OTHER	CAUCASIAN AFRICAN-AMERICAN OTHER	CAUCASIAN AFRICAN-AMERICAN OTHER

THE UNIVERSITY OF AKRON
DEPARTMENT OF CIVIL ENGINEERING

OHIO DEPARTMENT OF PUBLIC SAFETY

Figure 21: Site Survey Form

Appendix B Site List

Table 5: 2018 Site List

Site	District	County	Class	Address
101	1	Allen	Primary	I-75 SB Exit 127 @ SR 81/Findlay Road
102	1	Allen	Primary	I-75 NB Exit 130 @ E Bluelick Road
103	1	Allen	Secondary	SR 309/N Jameson Avenue SB @ Rice Avenue
104	1	Allen	Secondary	SR 117/Bellfontaine Avenue SEB @ S Shawnee Avenue
105	1	Allen	Local	N Main Street NB @ W North Street
106	1	Defiance	Secondary	US 24 SB Exit 22 @ SR 424/Baltimore Street
107	1	Defiance	Secondary	SR 2/SR 49/E High Street NEB @ S Maple Street
108	1	Fulton	Primary	I-80 Exit 25 @ SR 66 (both directions/toll exit)
109	1	Fulton	Primary	I-80 Exit 34 @ SR 108 (both directions/toll exit)
110	1	Fulton	Secondary	SR 2/Main Street EB @ Wood Street
111	1	Fulton	Secondary	SR 66 NB @ US 20A
112	1	Fulton	Local	CR H WB @ CR 13
113	1	Hancock	Primary	I-75 NB Exit 157 @ SR 12
114	1	Hancock	Primary	I-75 SB Exit 161 @ Township Highway 99
115	1	Hancock	Secondary	US 23/N Countyline Street SB @ W North Street
116	1	Hancock	Secondary	SR 18/Van Buren Street EB @ N Vine Street
117	1	Lucas	Primary	I-280 NB Exit 12 @ E Manhattan Boulevard
118	1	Lucas	Primary	I-75 Exit 208 WB @ E Manhattan Boulevard
119	1	Lucas	Secondary	SR 51/Monroe Street SEB @ Franklin Park Mall entrance 350 NW of Royer Road
120	1	Lucas	Secondary	US 20/SR 120/W Central Avenue WB @ Centennial Road
121	1	Lucas	Local	Sandra Drive SB @ W Laskey Road
122	1	Lucas	Local	Lewis Avenus SB @ Eleanor Avenue
123	1	Wood	Primary	I-75 SB Exit 179 @ US 6
124	1	Wood	Primary	I-75 NB Exit 179 @ US 6
125	1	Wood	Secondary	SR 18/Deshler Road EB @ N Main Street
126	1	Wood	Secondary	SR 795/Avenue Road WB @ Wyandot Place/Ramp to I-75 SB
127	1	Wood	Local	E Gypsy Lane Road/CR 324 EB @ County Home Road/S Dunbridge Road
201	2	Crawford	Secondary	SR 4/Sandusky Avenue SB @ SR 103
202	2	Crawford	Secondary	US 30/Bucyrus Bypass NB @ Exit to SR 98/Plymouth Street
203	2	Erie	Primary	I-80 Exit 110 (both directions/toll exit) @ SR 4/Hayes Avenue
204	2	Erie	Primary	I-80 Exit 118 (both directions/toll exit) @ US 250
205	2	Erie	Secondary	US 6/Warren Street SB @ Scott Street
206	2	Erie	Secondary	SR 13/Main Street NEB @ US 6/Cleveland Road E
207	2	Huron	Secondary	US 224 EB @ SR 13
208	2	Huron	Secondary	SR 60 SB @ SR 162
209	2	Marion	Secondary	SR 95/Mt Vernon Avenue WB @ SR 529/University Drive

210	2	Marion	Secondary	US 23 SB Exit @ SR 95
211	2	Ottawa	Primary	I-80 Exit 81 Both directions @ SR 51
212	2	Ottawa	Secondary	SR 105/Water Street WB @ Benton Street/W Main Street
213	2	Ottawa	Secondary	SR 53/NE Catawba Road SB @ SR 163/East Harbor Road
214	2	Richland	Primary	I-71 NB Exit 165 @ SR 97
215	2	Richland	Primary	I-71 SB Exit 169 @ SR 13
216	2	Richland	Secondary	SR 93/Cleveland Street NB @ SR 95/Newville Street
217	2	Richland	Secondary	SR 430/Park Avenue W EB @ Home Road
218	2	Richland	Local	W 6th Street WB @ Bowman Street
219	2	Sandusky	Primary	I-80 Exit 91 (both directions/toll exit)
220	2	Sandusky	Secondary	US 6/Main Street WB @ US 23
221	2	Sandusky	Secondary	US 20 Bypass Highway SEB @ SR 412/Castalia Street
222	2	Seneca	Secondary	SR 67/S Kilbourne Street NEB @ SR 162/W Jefferson Street
223	2	Seneca	Secondary	US 224 EB @ SR 18/US 224/Tiffin-Fostoria Road
301	3	Ashland	Primary	I-71 SB Exit 186 @ US 250
302	3	Ashland	Primary	I-71 NB Exit 186 @ US 250
303	3	Ashland	Secondary	US 42 SB @ Middle Rewsburg Road/CR 1302
304	3	Ashland	Secondary	SR 58 SB @ US 224
305	3	Cuyahoga	Primary	I-71 NB Exit 245 @ Fulton Rd
306	3	Cuyahoga	Primary	I-490 SB Exit 1B @ W 7th St
307	3	Cuyahoga	Secondary	US 42/Pearl Rd EB @ Greenleaf Ave
308	3	Cuyahoga	Secondary	SR 283/Lakeshore Blvd SWB @ S Lake Shore/E 189th St
309	3	Cuyahoga	Local	E 80th St NB @ Union Ave
310	3	Cuyahoga	Local	E 49th St NB @ Barkwill Ave
311	3	Lorain	Primary	I-80 Exit 135 @ Baumhart Road [both directions – toll exit]
312	3	Lorain	Primary	I-90 Exit 140 @ SR 58/Leavitt Road [both directions – toll exit]
313	3	Lorain	Secondary	OH 83/Avon Belden Road NB @ SR 57/Grafton-Eastern Road
314	3	Lorain	Secondary	SR 18/W Herrick Avenue EB @ SR 58/N Main Street
315	3	Lorain	Local	E River Street SB @ Broad Street
316	3	Medina	Primary	I-76 Exit 2 WB @ SR 3/Wooster Pike
317	3	Medina	Primary	I -271 Exit 3 NB @ SR 94/Ridge Road
318	3	Medina	Secondary	SR 301/Spencer Road NB @ SR 162/E Main Street
319	3	Medina	Secondary	SR 261/Akron Road WB @ Hartman Road/Co Rd 127
320	3	Medina	Local	Crystalbrooke Drive NB @ Mattingly Road/Township Rd 62
321	3	Stark	Primary	I-77 NB Exit 103 @ SR 800/Cleveland Avenue SW
322	3	Stark	Primary	I-77 SB Exit 109 @ Everhard Road NW
323	3	Stark	Secondary	SR 43/Market Avenue N SB @ 30th Street
324	3	Stark	Secondary	SR 93/Manchester Avenue NW SB @ SR 172/Richard Avenue
325	3	Stark	Local	Elton Street SW WB @ Pigeon Run Avenue
326	3	Summit	Primary	I-271 Exit 12 SB @ SR 303/W Streetsboro Road

327	3	Summit	Primary	I-271 Exit 19 SB @ SR 82/E Aurora Road
328	3	Summit	Secondary	SR 91/Darrow Road NB @ Twinsburg Road
329	3	Summit	Secondary	SR 261/West Avenue WB @ Nottingham Street
330	3	Summit	Local	Belleflower Road NB @ Bisson Avenue
331	3	Summit	Local	Stratford Street WB @ 31st Street SW
332	3	Wayne	Primary	I-71 NB Exit 198 @ SR 539/Congress Road
333	3	Wayne	Primary	I-71 NB Exit 196 @ SR 301/Elyria Road
334	3	Wayne	Secondary	SR 301/Elyria Road SB @ SR 302/Lattasburg Road
335	3	Wayne	Secondary	US 30/Lincoln Way WB @ Exit onto SR 3/Columbus Avenue
401	4	Ashtabula	Primary	I-90 EB Exit 241 @ SR 7
402	4	Ashtabula	Primary	I-90 EB Exit 218 @ SR 534
403	4	Ashtabula	Secondary	SR 531/9th Street EB @ Ohio Avenue
404	4	Ashtabula	Secondary	SR 534/S Broadway Street NB @ I-90 EB Exit 218 onramp
405	4	Columbiana	Secondary	SR 45 SB @ SR 9
406	4	Columbiana	Secondary	SR 45 SB @ Saltwell Road/CR 867
407	4	Geauga	Secondary	US 422 WB Exit 29 @ SR 44/Ravenna Road
408	4	Geauga	Secondary	SR 306/Chillicothe Road SB @ SR 87
409	4	Geauga	Local	Lake Avenue NB @ Springdale Avenue
410	4	Lake	Primary	I-90 WB Exit 189 @ Som Center Road
411	4	Lake	Primary	I-90 EB Exit 200 @ SR 44/Ravenna Road
412	4	Lake	Secondary	SR 91/Som Center Road NB @ Maplegrove Road
413	4	Lake	Secondary	US 20/Euclid Avenue NEB @ E 300th Street
414	4	Lake	Local	Driftwood Drive WB @ SR 283/Andrews Road
415	4	Mahoning	Primary	I-680 EB Exit 2 @ N Meridian Road
416	4	Mahoning	Primary	I-680 SB Exit 7 @ South Avenue
417	4	Mahoning	Secondary	SR 45/S Salem Warren Road SB @ US 224/W Akron-Canfield Road
418	4	Mahoning	Secondary	SR 289/Wilson Avenue NWB @ Rigby Street
419	4	Mahoning	Local	Struthers Road NB @ Arrel Road/CR 34
420	4	Portage	Primary	I-76 Exit 48 EB @ SR 225
421	4	Portage	Primary	I-76 Exit 38A EB @ SR 44/Ravenna Road
422	4	Portage	Secondary	US 224/Akron Canfield Road WB @ SR 43
423	4	Portage	Secondary	SR 43/Cleveland Canton Road SB @ SR 14/Cleveland-East Liverpool Road
424	4	Portage	Local	Eberly Road EB @ Industry Road and Waterloo Road
425	4	Trumbull	Primary	I-80 EB Exit 234A @ US 62
426	4	Trumbull	Primary	I-80 WB Exit 229 @ SR 193/Belmont Avenue
427	4	Trumbull	Secondary	SR 193/Belmont Avenue SB @ Tibbetts Wick Road
428	4	Trumbull	Secondary	SR 11 SB Exit 61 @ SR 5/Warren Road
429	4	Trumbull	Local	Belmont Avenue NB @ Fenton Street
501	5	Auglaize	Primary	I-75 NB Exit 110 @ US 33
502	5	Auglaize	Primary	I-75 SB Exit 111 @ SR 501
503	5	Auglaize	Secondary	SR 116 SB @ Deep Cut Road/SR 116
504	5	Auglaize	Secondary	SR 219/E Spring Street WB @ SR 29/N Main Street
505	5	Clark	Primary	I-70 WB Exit 66 @ SR 54
506	5	Clark	Primary	I-70 WB Exit 54 @ SR 72/S Limestone Street

507	5	Clark	Secondary	SR 41/Troy Road/W 1st Street WB @ Upper Valley Pike
508	5	Clark	Secondary	E National Road WB @ N Bird Road
509	5	Clark	Local	W Cassilly Street WB @ N Fountain Avenue
510	5	Darke	Secondary	SR 49A SB @ W South Street/SR 49
511	5	Darke	Secondary	SR 121/S Center Street NB @ Ward Street
512	5	Greene	Primary	I-675 NB Exit 22 @ SR 235/E Xenia Drive
513	5	Greene	Primary	I-675 SB Exit 16 @ Grange Hall Road
514	5	Greene	Secondary	US 42/S Church Street NB @ W 2nd Street
515	5	Greene	Secondary	US 35 WB @ Factory Road
516	5	Greene	Local	Wilmington-Dayton Pike SB @ SR 725/Centerville Road
517	5	Logan	Secondary	SR 366 WB @ SR 235
518	5	Logan	Secondary	SR 274 EB @ SR 638
519	5	Miami	Primary	I-75 NB Exit 82 @ US 36
520	5	Miami	Primary	I-75 SB Exit 78 @ N CR 25A
521	5	Miami	Secondary	SR 66/Broadway Street/Riverside Drive EB @ N CR 25A
522	5	Miami	Secondary	US 40/W National Road EB @ SR 202/Old Troy Pike
523	5	Miami	Local	W Kessler-Cowlesville Road EB @ Peters Road
524	5	Montgomery	Primary	I-70 WB Exit 38 @ SR 201
525	5	Montgomery	Primary	I-70 EB Exit 21 @ Arlington Road
526	5	Montgomery	Secondary	US 35 WB @ Exit onto Steve Whalen Boulevard
527	5	Montgomery	Secondary	SR 48/Main Street SEB @ Westbrook Road
528	5	Montgomery	Local	Kenosha Road WB @ Ackerman Boulevard
529	5	Montgomery	Local	Orchard Drive WB @ Shroyer Road
530	5	Preble	Primary	I-70 WB Exit 10 @ US 127
531	5	Preble	Primary	I-70 EB Exit 14 @ SR 503
532	5	Preble	Secondary	SR 725 WB @ SR 177
533	5	Preble	Secondary	US 127 SB @ SR 725/Central Avenue
601	6	Delaware	Primary	I-71 NB Exit 131 @ US 36
602	6	Delaware	Primary	I-71 NB Exit 121 @ SR 750/Polaris Parkway
603	6	Delaware	Secondary	US 36 EB @ S Houck Road
604	6	Delaware	Secondary	US 36 WB @ Access road to fast food and hotels 800 feet west of I-71 SB exit #131
605	6	Delaware	Local	Seldom Seen Road/CR 121 WB @ Sawmill Parkway
606	6	Fairfield	Primary	I-70 WB Exit 112 @ SR 256/Baltimore Reynoldsburg Road
607	6	Fairfield	Primary	I-70 EB Exit 112B @ SR 256/Baltimore Reynoldsburg Road
608	6	Fairfield	Secondary	SR 204/Blacklick Eastern Road NW SB @ Refugee Road/SR 204 EB
609	6	Fairfield	Secondary	SR 37/Granville Pike NB @ College Avenue
610	6	Fairfield	Local	Market Street SEB @ Center Street
611	6	Franklin	Primary	I-270 WB Exit 23 @ US 23
612	6	Franklin	Primary	I-70 WB Exit 94 @ Wilson Road
613	6	Franklin	Secondary	US 33/Riverside Drive NB @ Cranston Drive
614	6	Franklin	Secondary	US 23/Summit Street SB @ Warren Street
615	6	Franklin	Local	Westrock Drive SB @ Roberts Road E

616	6	Franklin	Local	Cunard Road NB @ Livingston Avenue
617	6	Knox	Secondary	SR 205/Danville Jelloway Road SB @ Main Street
618	6	Knox	Secondary	US 36/Columbus Road/Main Street NEB @ S Preston Street
619	6	Licking	Primary	I-70 EB Exit 132 @ SR 13
620	6	Licking	Primary	I-70 EB Exit 118 @ SR 310
621	6	Licking	Secondary	SR 37/Main Street/Johnstown-Alexandria Road NWB @ W Jersey Street
622	6	Licking	Secondary	US 62/Johnstown-Utica Road NW SWB @ SR 37/S Main Street/Johnstown-Alexandria Road
623	6	Licking	Local	York Road SW NB @ US 40
624	6	Madison	Primary	I-70 EB Exit 80 @ SR 29
625	6	Madison	Primary	I-71 NB Exit 84 @ SR 56
626	6	Madison	Secondary	US 40/National Pike WB @ SR 56/W Urbana-London Road
627	6	Madison	Secondary	SR 142/Columbus Cincinnati Road NEB @ US 40
628	6	Madison	Local	E 5th Street SWB @ N Main Street
629	6	Morrow	Primary	I-71 NB Exit 140 @ SR 61
630	6	Morrow	Primary	I-71 NB Exit 151 @ SR 95
631	6	Morrow	Secondary	SR 61 NB @ SR 288
632	6	Morrow	Secondary	SR 314/Chesterville Shelby SB @ SR 95/E Sandusky Street
633	6	Morrow	Local	West Point-Bellville Road WB @ SR 61
634	6	Perry	Secondary	SR 155/Main Street WB @ SR 13
635	6	Perry	Secondary	SR 13 NB @ SR 204
636	6	Perry	Local	Town Highway 54 NB @ US 22
637	6	Pickaway	Secondary	US 23/Walnut Street NB @ SR 316/Ashville Road
638	6	Pickaway	Secondary	SR 56/E Main Street EB @ N Pickaway Street
639	6	Pickaway	Local	S Main Street NB @ US 22/W Front Street
701	7	Belmont	Primary	I-70 EB Exit 216 @ SR 9/S Marietta Street
702	7	Belmont	Primary	I-70 EB Exit 225 @ Marion Street
703	7	Belmont	Secondary	US 40/E Main Street WB @ S Sugar Street
704	7	Belmont	Secondary	SR 7 WB Exit to Shadyside @ Central Avenue/Scenic OH 7
705	7	Belmont	Local	E South Street WB @ SR 147/Chestnut Street
706	7	Muskingum	Primary	I-70 WB Exit 157 @ SR 93
707	7	Muskingum	Primary	I-70 WB Exit 152 @ US 40
708	7	Muskingum	Secondary	SR 146/Marietta Street WB @ 9th Street/Wayne Avenue
709	7	Muskingum	Secondary	SR 60/S River Road NWB @ Bridge Street
710	7	Tuscarawas	Primary	I-77 NB Exit 93 @ SR 212
711	7	Tuscarawas	Primary	I-77 SB Exit 65 @ US 36
712	7	Tuscarawas	Secondary	SR 212 WB @ SR 800
713	7	Tuscarawas	Secondary	US RT 250 EB @ SR 93
801	8	Brown	Secondary	SR 756 NB @ SR 125
802	8	Brown	Secondary	SR 774 EB @ US 68/S High Street
803	8	Brown	Local	Purdy Road/S Main Street NB @ Winchester Street
804	8	Butler	Primary	I-75 NB Exit 22 @ Tylersville Road
805	8	Butler	Primary	I-75 SB Exit 24 @ Liberty Way

806	8	Butler	Secondary	SR 129/Michael A Fox Highway EB Exit 24 @ Cincinnati Dayton Road
807	8	Butler	Secondary	SR 126/Cincinnati Brookville Road EB @ Hamilton Cleves Road
808	8	Butler	Local	Kyles Station Road WB @ SR 4/Hamilton Middletown Road
809	8	Clermont	Primary	I-275 NB Exit 59A @ SR 450
810	8	Clermont	Primary	I-275 SB Exit 65 @ SR 125
811	8	Clermont	Secondary	US 50 WB @ SR 222
812	8	Clermont	Secondary	SR 276 NB @ US 50/E Main Street
813	8	Clermont	Local	SR 727 SB @ SR 131
814	8	Clinton	Primary	I-71 SB Exit 50 @ US 68
815	8	Clinton	Primary	I-71 NB Exit 45 @ SR 73
816	8	Clinton	Secondary	SR 28 EB @ SR 73/N South Street
817	8	Clinton	Secondary	SR 380 SB @ SR 73
818	8	Hamilton	Primary	I-275 WB Exit 47 @ Reed Hartman Highway
819	8	Hamilton	Primary	I-275 EB Exit 52 @ E Loveland Madeira Road
820	8	Hamilton	Secondary	US 22/SR 3/Montgomery Road NB @ Williams Avenue
821	8	Hamilton	Secondary	US 127/Central Parkway SB @ W 14th Street
822	8	Hamilton	Local	Delhi Avenue EB @ Glen Oaks Drive
823	8	Hamilton	Local	US 50/Lawrenceburg Road SB @ Louisville Pike
824	8	Warren	Primary	I-75 NB Exit 32 @ SR 122
825	8	Warren	Primary	I-71 NB Exit 36 @ Wilmington Road
826	8	Warren	Secondary	SR 123/Mill Street SB @ E Pike Street
827	8	Warren	Secondary	SR 63/W Main Street EB @ SR 123/Glosser Road/Neil Armstrong Way
828	8	Warren	Local	Greentree Road/CR 20 WB @ SR 741
901	9	Athens	Secondary	US 50/SR 32/E Bentbrook Drive EB @ Old Route 33
902	9	Athens	Secondary	SR 682/S Plains Road SB @ Connett Road
903	9	Ross	Secondary	US 23 NB @ SR 159/N Bridge Street
904	9	Ross	Secondary	US 50 WB @ Jones Road
905	9	Scioto	Secondary	US 23 SB @ CR 159
906	9	Scioto	Secondary	US 52/12th Street WB @ Lincoln Street

Appendix C Ohio Fatality Data

Table 6: Ohio Fatality Data (2010-2014)

County	Average Fatalities	Percent of State Fatalities	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
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

Note: Information obtained from NHTSA FARS data.

Appendix D Ohio Road Population Data

Table 7: Ohio Road Population Data

	Primary		Secondary		Local		Total	
County	Count	Sampled	Count	Sampled	Count	Sampled	Count	Sampled
Allen	157	2	1689	2	18829	1	20675	5
Ashland	114	2	2138	2	0	0	2252	4
Ashtabula	163	2	1940	2	0	0	2103	4
Athens	0	0	1720	2	0	0	1720	2
Auglaize	78	2	1655	2	0	0	1733	4
Belmont	294	2	2132	2	16905	1	19331	5
Brown	0	0	1602	2	10068	1	11670	3
Butler	87	2	1733	2	19470	1	21290	5
Clark	217	2	1235	2	9563	1	11015	5
Clermont	120	2	1563	2	10563	1	12246	5
Clinton	65	2	1141	2	0	0	1206	4
Columbiana	0	0	2430	2	0	0	2430	2
Crawford	0	0	1196	2	0	0	1196	2
Cuyahoga	1808	2	5068	2	46547	2	53423	6
Darke	0	0	2387	2	0	0	2387	2
Defiance	0	0	1655	2	0	0	1655	2
Delaware	84	2	1227	2	10479	1	11790	5
Erie	130	2	1446	2	0	0	1576	4
Fairfield	30	2	1317	2	12602	1	13949	5
Franklin	1778	2	3442	2	60020	2	65240	6
Fulton	142	2	1293	2	11161	1	12596	5
Geauga	0	0	714	2	4272	1	4986	3
Greene	184	2	1122	2	13475	1	14781	5
Hamilton	1175	2	2386	2	33483	2	37044	6
Hancock	167	2	1174	2	0	0	1341	4
Huron	0	0	2238	2	0	0	2238	2
Knox	0	0	2668	2	0	0	2668	2
Lake	275	2	1762	2	10750	1	12787	5
Licking	217	2	2919	2	33467	1	36603	5
Logan	0	0	1321	2	0	0	1321	2
Lorain	278	2	1996	2	16268	1	18542	5
Lucas	608	2	1846	2	22158	2	24612	6
Madison	105	2	882	2	3338	1	4325	5
Mahoning	544	2	2049	2	15202	1	17795	5
Marion	0	0	1022	2	0	0	1022	2
Medina	259	2	1166	2	7666	1	9091	5
Miami	156	2	1374	2	8765	1	10295	5
Montgomery	600	2	1788	2	35058	2	37446	6
Morrow	99	2	677	2	3619	1	4395	5
Muskingum	203	2	1459	2	0	0	1662	4
Ottawa	33	1	948	2	0	0	981	3
Perry	0	0	1123	2	5198	1	6321	3
Pickaway	0	0	818	2	3687	1	4505	3

Portage	243	2	2211	2	19995	1	22449	5
Preble	85	2	1449	2	0	0	1534	4
Richland	156	2	2615	2	21902	1	24673	5
Ross	0	0	1516	2	0	0	1516	2
Sandusky	166	1	1275	2	0	0	1441	3
Scioto	0	0	1540	2	0	0	1540	2
Seneca	0	0	1276	2	0	0	1276	2
Stark	191	2	2828	2	31684	1	34703	5
Summit	906	2	2215	2	30966	2	34087	6
Trumbull	206	2	2149	2	13859	1	16214	5
Tuscarawas	252	2	1956	2	0	0	2208	4
Warren	293	2	1293	2	13217	1	14803	5
Wayne	39	2	1950	2	0	0	1989	4
Wood	436	2	1767	2	11532	1	13735	5