

**Nebraska Seat Belt Use Survey  
2019 Data Collection  
Methodology Report**

**January 13, 2020**

**Revised January 28, 2020**

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# Nebraska Seat Belt Use Survey

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### Methodology Report

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#### Introduction

In an effort to achieve greater consistency and comparability in state-wide seat belt use reporting, the National Highway Traffic Safety Administration (NHTSA) issued new requirements in 2011 for observing and reporting future seat belt use. The requirements include the involvement of a qualified statistician in the sampling of specific road segments to be observed and in the data weighting process. A variety of specified operational details are also required. Each state prepares a plan that is approved by NHTSA and collects seat belt use data annually based on their approved plan. Every five years the sample of road segments must be redrawn based on updated information and approved by NHTSA.

In 2019, the Center for Survey Statistics & Methodology (CSSM) at Iowa State University was requested to collaborate with the Bureau of Sociological Research (BOSR) at the University of Nebraska – Lincoln to conduct the annual seat belt use survey for the State of Nebraska. CSSM has prepared the Iowa Seat Belt Use Plan and conducted observations for the State of Iowa since 2012. Because of its experience, CSSM prepared materials, conducted training, tabulated data, and prepared deliverable files for the Nebraska project. BOSR provided staffing for conducting and supervising the data collection process.

Primary contacts at each organization are listed below.

Simera Reynolds, Traffic Safety Specialist, Nebraska Department of Transportation

Lindsey Witt-Swanson, Associate Director, Bureau of Sociological Research, University of Nebraska - Lincoln

Janice Larson, Survey Research Unit Manager, Center for Survey Statistics and Methodology, Iowa State University

Jody Fox, Project Manager, Center for Survey Statistics & Methodology, Iowa State University

Emily Berg, PhD, Assistant Professor of Statistics, Iowa State University

This report describes the data collection process for obtaining 2019 Nebraska seat belt use data as stipulated by the approved study design. It also includes tables with overall results showing seat belt use in Nebraska.

#### Preparation

The Nebraska DOT provided CSSM with available materials from past seat belt data collection processes. This included Nebraska's original Seat Belt Use Survey Design from 2012, Note on Seat Belt Use Survey Reselection for 2017, the Nebraska Safety Belt Use 2018 Report, and a list of 72 sampled road segments. There were no specific project materials available from past Nebraska seat belt use data collection processes. CSSM planned and prepared materials for Nebraska's data collection in accordance with the Nebraska 2012 & 2017 plans approved by the National Highway Traffic Safety Administration. Preparation involved several components: verifying the usability of the sampled sites, preparing general and site-specific materials for Data Collectors, and notifying appropriate local personnel prior to data collection.

### Site Verification.

The Nebraska Seat Belt Survey Plan includes 72 road segments or sites sampled for annual observation, spread among 9 counties. Douglas County (Omaha) has 18 sampled segments, Lancaster (Lincoln) has 12. The remaining 7 counties each have 6 sampled road segments. The CSSM Project Manager examined the 72 sites for accessibility, safety, and practicality using Google Earth and other online sources. CSSM also checked the Nebraska Department of Transportation website to look for scheduled construction that could impact traffic patterns. No significant issues were discovered.

### Materials Preparation.

After the 72 sites were verified, CSSM staff used online maps and Google Earth to identify and recommend observation points that would be safe and still provide the visibility necessary to observe seat belt use. CSSM staff prepared maps for Data Collectors to use as references when traveling to and locating sites. Equipment was prepared for use by Data Collectors, including vests, signs, stop watches, and clickers. Data collection forms were printed. Data collection schedules were prepared for each site and administrative procedures were documented.

### Notification.

CSSM prepared a list of appropriate city/county law enforcement personnel to be notified about the project. This list was forwarded to BOSR for use once the observation schedule was finalized. CSSM understood that BOSR would notify appropriate municipal law enforcement and Nebraska DOT personnel would notify state highway patrol and other applicable DOT personnel. The purpose was to ensure that appropriate officials in each site area would be aware of the project and the days and times that Data Collectors would be at work in their area. However, this policy was inconsistently followed. CSSM was informed that no municipal law enforcement agencies were notified, and highway patrol in one county (Sarpy) was not notified prior to data collection. As a result, one Data Collector working on an interstate overpass in Sarpy County was stopped by a state trooper and told to leave. The Data Collector showed the trooper his letter of identification and explained the project and its purpose, but the trooper still insisted the Data Collector stop his work and leave the area. This incident emphasizes the importance of prenotification of law enforcement in the future.

## Data Collection Staff Training

Nebraska utilized four primary data collectors in 2019, responsible for 18 sites each. Quality Control functions were filled by BOSR staff members.

CSSM conducted a two-day project training which was held at BOSR in Lincoln on August 8 & 9, 2019, with field data collection beginning on August 12, 2019. (See the agenda in Figure 1.) The training included a combination of lecture, classroom and field exercises. Training sessions covered data collection protocols, including how to find the observation sites, choosing an observation location, how to properly collect data, defining seat belt “use,” “nonuse,” and “use unknown,” what to do if data cannot be collected at a site due to road construction, weather, or other circumstances, and the appropriate management and submission of collected data. Roadside safety training was provided by a safety representative from the Nebraska DOT.

Responsibilities of Quality Control monitors were also reviewed at the training. QC duties include conducting unannounced site visits to a minimum of two sites for each Data Collector (11% of the total sites) and reviewing the Data Collector’s field protocol. The QC Monitors met with the Data Collectors in the field to answer questions and offer assistance as needed.

Data Collectors were provided with bright yellow vests to wear for safety. Data Collectors were instructed to use their car’s flashing lights as needed for safety, and a clicker counter was made available to use as needed. Personal phones would provide a stopwatch function. Each Data Collector was provided with two “Survey Crew Ahead” signs and sandbag weights for use in high speed areas and other sites as appropriate.

### Observation Protocols and Procedures

All passenger vehicles, including commercial vehicles weighing less than 10,000 pounds, were eligible for observation. Data Collectors completed two forms in the field, the Observation Site Form and the Observation Tally Form, which are shown in Appendix A and B. The Observation Site Form documented descriptive information about each site. Data Collectors recorded information including observation date, site location and number, alternative site data, traffic directions and lanes available and observed, start and end times for observations, and weather conditions.

The Observation Tally Form was used to mark seat belt use/non-use/unknown use for drivers and right front passengers.

Using the Observation Tally Form, seat belt use observations were made of all passenger vehicle drivers and right front seat occupants in the selected lane. The only passenger vehicle right front seat occupants excluded from the study were child passengers traveling in child seats with harness straps. If there was no passenger in the right front seat of an observed vehicle, that information was also noted on the Observation Tally Form.

**Seat Belt use categories** - Data Collectors recorded belt use for the driver and right front seat passenger using the definitions shown in Figure 2 below, which were provided in the federal regulations.

Figure 2.

| Code | Meaning      | Definition  |
|------|--------------|---|
| Y    | Yes, belted  | The shoulder belt is in front of the person’s shoulder.                                   |
| N    | No, unbelted | The shoulder belt is not in front of the person’s shoulder.                               |
| U    | Unknown      | It cannot reasonably be determined whether the driver or right front passenger is belted. |
| NP   | No passenger | There is no right front passenger present.  |

| <b>Figure 1. Seat Belt Data Collectors<br/>2019 Training Agenda</b> |   |
|---|---|
| <b>Thursday, August 8, 2019</b>                                     |   |
| Seat Belt Survey Overview   | Study Design<br>NHTSA Requirements<br>Data Collection Requirements<br>Definitions of terms                              |
| Data Collection Procedures  | Assignments & Rescheduling  |
| Site Locations  | Low/High volume roadways<br>Locating assigned sites<br>Site assignment sheets & maps                                    |
| Data Collection   | Data Collection & Observation forms<br>Recording observations<br>Recording alternate site information<br>Traffic Counts |
| Site Review on Google Earth   |   |
| <b>Friday, August 9, 2019</b>                                       |   |
| Safety Training (NDOT representative)                               | Signage and visibility<br>Roadway safety  |
| Quality Control and QC monitoring                                   |   |
| Field Practice  | Setting up road work signs<br>Practice observations   |

## Scheduling.

Data collectors were generally assigned six sites in one county per work day. One data collector was assigned 12 of the Douglas County sites and the remaining 6 were assigned to another data collector. The 12 Lancaster county sites were divided between two data collectors. A daily schedule of sites with observation start times was provided by CSSM in order to ensure a representative sampling of times of day for the data collection, but BOSR assigned the days of the week and data collector for each group of 6 sites. Observations were to start at the assigned times, as much as possible, and to continue for exactly 45 minutes.

## Observations.

Data Collectors were instructed to observe one lane and one direction of travel per observation site. The direction of travel was randomly assigned by the office; however, Data Collectors were allowed to observe the other direction if safety or windshield glare dictated. Deviations from the randomly assigned direction were noted on the Observation Site Form. In a few cases, traffic on the assigned segment was so minimal that both directions of travel were observed. If an assigned road segment included an intersection, Data Collectors were instructed to observe traffic traveling on the assigned road segment, not the cross-street.

Lower volume roadways such as county roads and streets were observed from a field drive or other location where Data Collectors could safely move their vehicles from the roadway. In some situations, data collectors observed from their vehicle while, in most cases, observing from outside of the vehicle was more effective.

Whenever possible, observations for high-volume, limited access roadways were made from an overpass. Observing from an overpass allowed for comparatively easy viewing of seatbelt use for both the driver and the passenger. Gravel road overpasses were preferred because of the low traffic volume, reducing safety hazards to the data collector. In some instances, observing from an overpass required moving the observation point from the specific road segment by a couple of miles; however, because of the limited exit and entrance to these roadways, there were no significant changes to the observed vehicles between the assigned road segment and the observation point.

If a low volume overpass is not available, Data Collectors are allowed to observe traffic at an exit ramp or rest stop. In these cases, because the exit ramp/rest stop only samples a portion of the traffic passing on the main highway, an additional traffic volume count is required in order to adjust for the reduced numbers. Only one rest stop site was used in 2019. The Data Collector completed a 45-minute observation period at a rest stop exit ramp. Then the Data Collector counted passing cars in one direction and in one lane of the assigned interstate road segment, timing the number of minutes to reach a count of 100 cars. This traffic count information was recorded on the Observation Site Form and was used to adjust the seat belt usage observation data.

## Alternate Sites.

If unexpected construction or difficulty in locating a useable and safe place to observe required the Data Collector to deviate farther than 2 miles (or more than one block in city situations) from the selected road segment, he/she was instructed to call the office before proceeding and to note the location as an alternate site on the Observation Site form. For the 2019 data collection, no unanticipated alternate sites were needed.

## Rescheduling.

If an assigned road segment was temporarily unavailable due to a traffic accident or inclement weather, data collection was to be rescheduled another week for the same time and day of the week. In 2019 there were three days with a little light rain, but no rescheduling was needed due to either weather or accidents.

## Results

Data collection for 2019 occurred from Monday, August 12 through Friday, August 30, 2019. The 2019 seat belt use data collection resulted in the observation of 8,380 passenger vehicles, with a right front seat passenger in 2,175 of those vehicles, for a total of 10,555 potential observations of belt use. Of these 10,555 potential observations, there were 6,639 drivers and 1,701 right front passengers who were observed to be wearing seat belts (total 8,340 seat belt users). Seat belts were not worn by 1,491 drivers and 408 right front passengers (total 1,899 unbelted). Data collectors were unable to observe the seat belt use of 250 drivers and 66 passengers (total 316 unknown use).

The unknown use, or “nonresponse rate,” for the August data collection was .0299 or 2.99%. This was well within the range allowed by federal regulations (1340.9f), which require the nonresponse rate to be below 10%.

Quality control checks were completed with each of the four primary Data Collectors to ensure compliance with project protocols. Three Data Collectors were observed by a QC monitor throughout an entire day of observations, and one Data Collector was observed at two sites. This comprises 28% of the sites (20 out of 72), which far exceeds the minimum of 5% required by federal regulations. However, the regulations (1340.8a) stipulate that QC visits should be “unannounced,” which was not the case here. Future data collection should include unannounced quality control checks. No data collection problems were identified through these quality control checks.

Federal regulations require the calculation of seat belt use to be conducted with weighted data as described in the approved survey plan. Data weighting was completed by Dr. Emily Berg, Assistant Professor of Statistics at Iowa State University.

Results from the August data collection indicated that Nebraska’s overall weighted seat belt use rate for 2019 was 76.0%, with an estimated standard error of .038, or 3.8%. This was higher than the maximum allowable standard error of 2.5 percentage points (1340.9g). In addition, the 2019 weighted safety belt use rate of 76% was approximately 9 percentage points lower than the 2018 weighted estimate of 85.5%.

CSSM examined the status of the August data collection and Dr. Berg recalculated weights and standard error following several different procedures but with no significant change in the results. CSSM identified possible reasons for the decrease in weighted seat belt use. First, it is not known with certainty which road segments were observed in 2018. A list of sampled road segments provided by the Nebraska DOT was used for 2019 observations, but they may or may not be the same as those used in 2018. The CSSM statistician was able to match the selection probability of most of the 2018 and 2019 road segments, but that also does not mean the same road segments were visited. Second, it was speculated that the decline could be a function of a change in data collection procedures. All data in past years was collected by one observer. The 2019 data was collected by four newly trained observers. It is possible that the visual interpretation of what appears to be belted or unbelted was understood differently. For example, in 2018 there were 16 vehicle occupants observed with unknown belt use, while in 2019 there were 316 occupants observed with unknown belt use. This indicates that the change in observer staff could have made a significant impact on belt use identification as well.

Results from the August data collection were submitted to NHTSA by the Nebraska DOT, however in late December they were informed that the 2019 data was unacceptable since the standard error exceeded 2.5%. After consultation with Dr. Berg, the Nebraska DOT completed observations of an additional 3,329 cars with

800 right front passengers on December 26-31, 2019. The observations completed in December were added to the August observations for analysis and reporting.

The additional December observations increased the total number of occupants observed to 14,684, including 11,709 drivers and 2,975 right front passengers. When weighted by Dr. Berg, **Nebraska’s overall weighted seat belt use rate for 2019 is 79.7%**, with an **estimated standard error of .023, or 2.3%**. This meets NHTSA’s requirement that the standard error should be less than 2.5 percentage points.

Factoring in the December observations, the final **unknown use, or “nonresponse rate,” is .0268 or 2.68%**. Federal regulations (1340.9f) require the nonresponse rate to be below 10%.

Figure 3 below shows Nebraska’s final 2019 weighted average seat belt use for drivers, passengers, and total occupants as well as the estimated standard error.

**Figure 3. 2019 Nebraska Safety Belt Use, weighted**

|              | N      | 2019 Belted Estimate<br>(S.E. in Parentheses) | 95% CI<br>Lower | 95% CI<br>Upper |
|--------------|--------|---|-----------------|-----------------|
| Total Sample | 14,684 | 0.797<br>(0.023)                              | 0.754           | 0.842           |
| Drivers      | 11,709 | 0.800<br>(0.022)                              | 0.756           | 0.844           |
| Passengers   | 2,975  | 0.785<br>(0.030)                              | 0.726           | 0.843           |

Estimation and variance estimation procedures followed by Dr. Berg are appended to the end of this report.

## Recommendations

Recommendations for future seat belt use observations include both minor operational components and sampling issues with major implications for future weighting and estimation.

- Any available information regarding past seat belt observation procedures and weighting should be obtained.
- The identification of sampled road segments should be clarified.
- Road segments with no or minimal traffic observed in 2019 should be replaced with alternate sampled road segments.
- Observers should be instructed to follow all documented procedures, including those that apply to exit ramps or rest areas.
- More practice sessions should be completed by observers, including 10-15 minute observation periods conducted independently by 2 or more observers and compared for reliability.
- Observers should be instructed to contact the Project Manager for instructions when unusual circumstances arise.
- Observation results should be reviewed as soon as possible by the Project Manager so that additional or replacement observations can be obtained if needed.
- Quality Control visits should be unannounced, as described in the regulations.



- Observation periods should be increased from 45 minutes to a minimum of 60 minutes. Whether observations longer than 60 minutes are advisable depends upon other potential adjustments to the sampling plan (see the item below).
- From a sampling perspective, Dr. Berg recommends increasing the number of primary sampling units. This can be accomplished in two ways. One way is to select more than 7 non-certainty counties. Alternatively, the number of road segments selected within the two certainty counties, Douglas and Lancaster, could be increased. It appears that Sarpy county is considered urban but is not included with certainty. Including Sarpy with certainty and increasing the number of road segments selected in Sarpy county would increase the number of primary sampling units in the sample.

## Tables and Appendices

Table 1 shows state-wide weighted Nebraska Safety Belt Use for 2019 and 2018.

Table 2 lists the 72 observation sites with selected characteristics and the number of belted drivers and right front passengers for each site. This data is unweighted.

Tables 3 and 4 show the seat belt use of drivers and passengers by county. Table 3 contains the number or count of each category of belt use by drivers, passengers, and total for each sampled county. Table 4 contains two types of unweighted percentages of belt use for drivers, passengers, and combined total for each county. The “% of Total Belted” is the percent of the total number of persons (both drivers and passengers) who were belted. The “% of Known Belted” removes the persons with unknown belt use from the base number. Note that these percentages are unweighted and the state-wide seat belt use percentage is slightly different than the weighted seat belt use percentage required by federal regulations for reporting. Nevertheless, the unweighted percentages in Table 4 enable legitimate comparisons between seat belt users/nonusers and between counties.

Tables 5 and 6 show the seat belt use of drivers and passengers by road type. Table 4 contains the number in each category and Table 5 contains unweighted percentages. Federal regulations required the new survey plan to classify road types as primary (including interstates), secondary, and local.

Table 7 contains seat belt use of drivers and passengers by day of the week. The percentages included in the table are unweighted.

Table 8 contains seat belt use of drivers and passengers by time of day. The percentages included in the table are unweighted.

Table 9 contains sample weights for each observation site as well as seat belt use for drivers and passengers (number or count). This information is used for Part B reporting purposes. It is also provided in an Excel file accompanying this report.

Appendix A. Observation Site Form

Appendix B. Observation Count Form

Estimation and variance estimation procedures are appended to the end of this report.

**Table 1. 2019 and 2018 Nebraska Safety Belt Use, weighted estimates**

|              | <b>2019<br/>N</b> | <b>2019<br/>Belted<br/>Estimate</b> | <b>2019<br/>Standard<br/>Error</b> | <b>2018<br/>N</b> | <b>2018<br/>Belted<br/>Estimate</b> | <b>2018<br/>Standard<br/>Error</b> |
|--------------|-------------------|-------------------------------------|------------------------------------|-------------------|-------------------------------------|------------------------------------|
| Total Sample | 14,684            | 0.797                               | (0.023)                            | 13,704            | 0.855                               | (0.012)                            |
| Drivers      | 11,709            | 0.800.                              | (0.022)                            | 10,171            | 0.849                               | (0.014)                            |
| Passengers   | 2,975             | 0.785                               | (0.030)                            | 3,533             | 0.873                               | (0.023)                            |

**Table 2. 2019 Seat Belt Usage**

| Site # | County    | Location             | Road Type | Days of the Week | Vehicle Count | Drivers Belted | Passenger Count | Passenger Belted |
|--------|-----------|----------------------|-----------|------------------|---------------|----------------|-----------------|------------------|
| 1001   | Buffalo   | US Hwy 183           | Secondary | Fri              | 40            | 30             | 12              | 10               |
| 1002   | Buffalo   | US Hwy 183           | Secondary | Fri              | 25            | 17             | 6               | 6                |
| 1003   | Buffalo   | I- 80                | Primary   | Fri              | 435           | 392            | 247             | 199              |
| 1004   | Buffalo   | E 25th St            | Secondary | Fri              | 420           | 228            | 114             | 64               |
| 1005   | Buffalo   | I- 80                | Primary   | Fri              | 435           | 339            | 226             | 157              |
| 1006   | Buffalo   | State Hwy 10         | Secondary | Fri              | 213           | 158            | 45              | 34               |
| 2001   | Cheyenne  | US Hwy 385           | Secondary | Thurs            | 91            | 68             | 18              | 15               |
| 2002   | Cheyenne  | I- 80                | Primary   | Thurs            | 88            | 79             | 34              | 29               |
| 2003   | Cheyenne  | US Hwy 30            | Secondary | Thurs            | 40            | 23             | 8               | 7                |
| 2004   | Cheyenne  | Upland Pkwy          | Secondary | Thurs            | 119           | 69             | 36              | 21               |
| 2005   | Cheyenne  | I- 80                | Primary   | Thurs            | 126           | 120            | 68              | 52               |
| 2006   | Cheyenne  | I- 80                | Primary   | Thurs            | 120           | 95             | 74              | 57               |
| 3001   | Dodge     | US Hwy 275           | Secondary | Wed/Fri          | 213           | 156            | 53              | 38               |
| 3002   | Dodge     | US Hwy 275           | Secondary | Wed/Fri          | 157           | 122            | 45              | 34               |
| 3003   | Dodge     | US Hwy 275           | Secondary | Wed/Fri          | 197           | 152            | 66              | 49               |
| 3004   | Dodge     | State Hwy 91         | Secondary | Wed/Fri          | 121           | 89             | 30              | 22               |
| 3005   | Dodge     | State Hwy 79         | Secondary | Wed/Fri          | 33            | 24             | 0               | 0                |
| 3006   | Dodge     | N Broad St           | Secondary | Wed/Fri          | 239           | 182            | 52              | 37               |
| 4001   | Douglas   | NHWS Cleveland Blvd  | Local     | Tues/Sun         | 48            | 43             | 12              | 12               |
| 4002   | Douglas   | Blair High Rd        | Secondary | Tues/Fri         | 418           | 358            | 65              | 54               |
| 4003   | Douglas   | Blair High Rd        | Secondary | Tues/Fri         | 482           | 398            | 63              | 53               |
| 4004   | Douglas   | N 79th St            | Local     | Tues/Sat         | 6             | 6              | 2               | 2                |
| 4005   | Douglas   | Caldwell St          | Local     | Tues/Sun         | 6             | 6              | 0               | 0                |
| 4006   | Douglas   | N 12th St            | Local     | Tues/Sat         | 204           | 174            | 17              | 13               |
| 4007   | Douglas   | 240th St             | Secondary | Thurs/Sun        | 432           | 357            | 164             | 147              |
| 4008   | Douglas   | S 234th St           | Local     | Thurs            | 2             | 1              | 0               | 0                |
| 4009   | Douglas   | Adams St             | Local     | Thurs            | 6             | 4              | 1               | 1                |
| 4010   | Douglas   | S 156th Avenue Cir   | Local     | Thurs            | 4             | 3              | 1               | 1                |
| 4011   | Douglas   | S 118th St           | Local     | Thurs/Sun        | 19            | 16             | 6               | 4                |
| 4012   | Douglas   | I- 680               | Primary   | Thurs            | 867           | 725            | 91              | 72               |
| 4013   | Douglas   | I- 80                | Primary   | Wed              | 452           | 330            | 9               | 9                |
| 4014   | Douglas   | Arbor St             | Local     | Wed/Sat          | 24            | 18             | 6               | 2                |
| 4015   | Douglas   | S 4th St             | Local     | Wed/Sat          | 5             | 4              | 0               | 0                |
| 4016   | Douglas   | I- 480               | Primary   | Wed              | 442           | 318            | 25              | 18               |
| 4017   | Douglas   | S 67th St            | Local     | Wed/Sun          | 372           | 307            | 96              | 79               |
| 4018   | Douglas   | S 89th Ct            | Local     | Wed              | 4             | 2              | 0               | 0                |
| 5001   | Holt      | US Hwy 20            | Secondary | Sat              | 25            | 18             | 6               | 5                |
| 5002   | Holt      | US Hwy 20            | Secondary | Sat              | 48            | 42             | 26              | 23               |
| 5003   | Holt      | US Hwy 20            | Secondary | Sat              | 94            | 64             | 35              | 31               |
| 5004   | Holt      | US Hwy 20            | Secondary | Sat              | 87            | 44             | 30              | 22               |
| 5005   | Holt      | State Hwy L-45B      | Secondary | Sat              | 6             | 4              | 2               | 1                |
| 5006   | Holt      | State Hwy L-45B      | Secondary | Sat              | 6             | 4              | 1               | 1                |
| 6001   | Lancaster | W Wittstruck Rd      | Local     | Mon/Mon          | 15            | 12             | 6               | 2                |
| 6002   | Lancaster | SW 100th St          | Local     | Mon/Mon          | 42            | 33             | 8               | 7                |
| 6003   | Lancaster | SW 100th St          | Local     | Mon/Mon          | 4             | 3              | 1               | 1                |
| 6004   | Lancaster | S 12th St            | Secondary | Mon/Tues         | 404           | 348            | 81              | 64               |
| 6005   | Lancaster | S 35th St            | Local     | Mon/Thurs        | 48            | 39             | 6               | 6                |
| 6006   | Lancaster | Aspen Canyon Rd      | Local     | Mon/Thurs        | 12            | 11             | 0               | 0                |
| 6007   | Lancaster | NW 48th St           | Local     | Sun/Sun          | 92            | 71             | 20              | 16               |
| 6008   | Lancaster | W Harvest Dr         | Local     | Sun              | 8             | 5              | 3               | 2                |
| 6009   | Lancaster | I- 80                | Primary   | Sun              | 227           | 203            | 90              | 82               |
| 6010   | Lancaster | I- 80                | Primary   | Sun              | 333           | 296            | 145             | 133              |
| 6011   | Lancaster | David Dr             | Local     | Sun/Thurs        | 9             | 7              | 2               | 2                |
| 6012   | Lancaster | O St                 | Secondary | Sun/Thurs        | 660           | 602            | 195             | 170              |
| 7001   | Otoe      | N 58th Rd            | Secondary | Mon/Fri          | 250           | 202            | 43              | 33               |
| 7002   | Otoe      | Sterling Morton Btwy | Secondary | Mon/Fri          | 298           | 206            | 61              | 47               |

| Site # | County | Location           | Road Type | Days of the Week | Vehicle Count | Drivers Belted | Passenger Count | Passenger Belted |
|--------|--------|--------------------|-----------|------------------|---------------|----------------|-----------------|------------------|
| 7003   | Otoe   | S 48th Rd          | Secondary | Mon/Fri          | 98            | 64             | 27              | 21               |
| 7004   | Otoe   | Spr 66F            | Secondary | Mon/Fri          | 29            | 18             | 11              | 8                |
| 7005   | Otoe   | S 30th Rd          | Secondary | Mon/Fri          | 221           | 156            | 51              | 31               |
| 7006   | Otoe   | State Hwy 2        | Secondary | Mon/Fri          | 349           | 244            | 84              | 60               |
| 8001   | Sarpy  | I- 80              | Primary   | Mon              | 219           | 210            | 66              | 63               |
| 8002   | Sarpy  | Shamrock Rd        | Local     | Fri/Fri          | 22            | 17             | 7               | 6                |
| 8003   | Sarpy  | State Hwy 370      | Secondary | Fri/Sun          | 361           | 314            | 82              | 65               |
| 8004   | Sarpy  | Barksdale Dr       | Local     | Fri              | 19            | 17             | 2               | 2                |
| 8005   | Sarpy  | Eagle Crest Dr     | Local     | Fri/Sat          | 28            | 25             | 6               | 6                |
| 8006   | Sarpy  | S 93rd St          | Local     | Fri/Sat          | 18            | 16             | 7               | 6                |
| 9001   | Seward | I- 80              | Primary   | Tues             | 169           | 147            | 87              | 77               |
| 9002   | Seward | 5th St             | Secondary | Tues/Sun         | 105           | 68             | 24              | 15               |
| 9003   | Seward | I- 80              | Primary   | Tues             | 13            | 12             | 2               | 2                |
| 9004   | Seward | McKelvie Rd/Hwy 34 | Secondary | Tues/Sun         | 209           | 167            | 32              | 26               |
| 9005   | Seward | Alvo Rd/Hwy 34     | Secondary | Tues/Sun         | 185           | 143            | 20              | 15               |
| 9006   | Seward | 154th              | Secondary | Tues             | 91            | 68             | 14              | 11               |
|        |        |                    |           |                  | <b>11,709</b> | <b>9,313</b>   | <b>2,975</b>    | <b>2,360</b>     |

**Table 3. 2019 Driver and Passenger Seat Belt Use by County (n)**

| County       | Drivers       |              |              |            | Right Front Passengers |              |            |           | TOTAL         |               |             |            |
|--------------|---------------|--------------|--------------|------------|------------------------|--------------|------------|-----------|---------------|---------------|-------------|------------|
|              | Total         | Belted       | Not Belted   | Un-known   | Total                  | Belted       | Not Belted | Un-known  | Total         | Belted        | Not Belted  | Un-known   |
| Buffalo      | 1,568         | 1,164        | 396          | 8          | 650                    | 470          | 174        | 6         | 2,218         | 1,634         | 570         | 14         |
| Cheyenne     | 584           | 454          | 124          | 6          | 238                    | 181          | 54         | 3         | 822           | 635           | 178         | 9          |
| Dodge        | 960           | 725          | 183          | 52         | 246                    | 180          | 38         | 28        | 1,206         | 905           | 221         | 80         |
| Douglas      | 3,793         | 3,070        | 567          | 156        | 558                    | 467          | 75         | 16        | 4,351         | 3,537         | 642         | 172        |
| Holt         | 266           | 176          | 86           | 4          | 100                    | 83           | 17         | 0         | 366           | 259           | 103         | 4          |
| Lancaster    | 1,854         | 1,630        | 200          | 24         | 557                    | 485          | 68         | 4         | 2,411         | 2,115         | 268         | 28         |
| Otoe         | 1,245         | 890          | 343          | 12         | 277                    | 200          | 70         | 7         | 1,522         | 1,090         | 413         | 19         |
| Sarpy        | 667           | 599          | 61           | 7          | 170                    | 148          | 20         | 2         | 837           | 747           | 81          | 9          |
| Seward       | 772           | 605          | 117          | 50         | 179                    | 146          | 24         | 9         | 951           | 751           | 141         | 59         |
| <b>Total</b> | <b>11,709</b> | <b>9,313</b> | <b>2,077</b> | <b>319</b> | <b>2,975</b>           | <b>2,360</b> | <b>540</b> | <b>75</b> | <b>14,684</b> | <b>11,673</b> | <b>2617</b> | <b>394</b> |

**Table 4. 2019 Driver and Passenger Seat Belt Use by County (unweighted percentages)**

| County       | Drivers           |                   | Right Front Passengers |                   | TOTAL             |                   |
|--------------|-------------------|-------------------|------------------------|-------------------|-------------------|-------------------|
|              | % of Total Belted | % of Known Belted | % of Total Belted      | % of Known Belted | % of Total Belted | % of Known Belted |
| Buffalo      | 74.2%             | 74.6%             | 72.3%                  | 73.0%             | 73.7%             | 74.1%             |
| Cheyenne     | 77.7%             | 78.5%             | 76.1%                  | 77.0%             | 77.3%             | 78.1%             |
| Dodge        | 75.5%             | 79.8%             | 73.2%                  | 82.6%             | 75.0%             | 80.4%             |
| Douglas      | 80.9%             | 84.4%             | 83.7%                  | 86.2%             | 81.3%             | 84.6%             |
| Holt         | 66.2%             | 67.2%             | 83.0%                  | 83.0%             | 70.8%             | 71.5%             |
| Lancaster    | 87.9%             | 89.1%             | 87.1%                  | 87.7%             | 87.7%             | 88.8%             |
| Otoe         | 71.5%             | 72.2%             | 72.2%                  | 74.1%             | 71.6%             | 72.5%             |
| Sarpy        | 89.8%             | 90.8%             | 87.1%                  | 88.1%             | 89.2%             | 90.2%             |
| Seward       | 78.4%             | 83.8%             | 81.6%                  | 85.9%             | 79.0%             | 84.2%             |
| <b>Total</b> | <b>79.5%</b>      | <b>81.8%</b>      | <b>79.3%</b>           | <b>81.4%</b>      | <b>79.5%</b>      | <b>81.7%</b>      |

**Table 5. 2019 Seat Belt Use by Road Type (n)**

| Road Type    | Drivers       |              |              |            | Right Front Passengers |              |            |           | Total         |               |              |            |
|--------------|---------------|--------------|--------------|------------|------------------------|--------------|------------|-----------|---------------|---------------|--------------|------------|
|              | Total         | Belted       | Not Belted   | Un-Known   | Total                  | Belted       | Not Belted | Un-Known  | Total         | Belted        | Not Belted   | Un-Known   |
| Local        | 1,017         | 840          | 157          | 20         | 209                    | 170          | 36         | 3         | 1,226         | 1,010         | 193          | 23         |
| Primary      | 3,926         | 3,266        | 548          | 112        | 1,164                  | 950          | 194        | 20        | 5,090         | 4,216         | 742          | 132        |
| Secondary    | 6,766         | 5,207        | 1,372        | 187        | 1,602                  | 1,240        | 310        | 52        | 8,368         | 6,447         | 1,682        | 239        |
| <b>TOTAL</b> | <b>11,709</b> | <b>9,313</b> | <b>2,077</b> | <b>319</b> | <b>2,975</b>           | <b>2,360</b> | <b>540</b> | <b>75</b> | <b>14,684</b> | <b>11,673</b> | <b>2,617</b> | <b>394</b> |

**Table 6. 2019 Seat Belt Use by Road Type (unweighted percentages)**

| Road Type    | Drivers           |                   | Right Front Passengers |                   | TOTAL             |                   |
|--------------|-------------------|-------------------|------------------------|-------------------|-------------------|-------------------|
|              | % of Total Belted | % of Known Belted | % of Total Belted      | % of Known Belted | % of Total Belted | % of Known Belted |
| Local        | 82.6%             | 84.3%             | 81.3%                  | 82.5%             | 82.4%             | 84.0%             |
| Primary      | 83.2%             | 85.6%             | 81.6%                  | 83.0%             | 82.8%             | 85.0%             |
| Secondary    | 77.0%             | 79.1%             | 77.4%                  | 80.0%             | 77.0%             | 79.3%             |
| <b>TOTAL</b> | <b>79.5%</b>      | <b>81.8%</b>      | <b>79.3%</b>           | <b>81.4%</b>      | <b>79.5%</b>      | <b>81.7%</b>      |

**Table 7. 2019 Driver and Passenger Seat Belt Use by Day of Week (n & unweighted %)**

|                  | <b>Drivers<br/>Belted</b> | <b>Total<br/>Drivers</b> | <b>Passengers<br/>Belted</b> | <b>Total<br/>Passengers</b> | <b>% Drivers<br/>Belted</b> | <b>% Passengers<br/>Belted</b> |
|------------------|---------------------------|--------------------------|------------------------------|-----------------------------|-----------------------------|--------------------------------|
| <b>Sunday</b>    | 1,630                     | 1,861                    | 605                          | 679                         | 87.6%                       | 89.1%                          |
| <b>Monday</b>    | 805                       | 1,004                    | 220                          | 284                         | 80.2%                       | 77.5%                          |
| <b>Tuesday</b>   | 1,344                     | 1,590                    | 218                          | 265                         | 84.5%                       | 82.3%                          |
| <b>Wednesday</b> | 1,089                     | 1,502                    | 109                          | 167                         | 72.5%                       | 65.3%                          |
| <b>Thursday</b>  | 1,602                     | 1,955                    | 337                          | 434                         | 81.9%                       | 77.6%                          |
| <b>Friday</b>    | 2,564                     | 3,410                    | 765                          | 1,016                       | 75.2%                       | 75.3%                          |
| <b>Saturday</b>  | 279                       | 387                      | 106                          | 130                         | 72.1%                       | 81.5%                          |
| <b>Total</b>     | <b>9,313</b>              | <b>11,709</b>            | <b>2,360</b>                 | <b>2,975</b>                | <b>79.5%</b>                | <b>79.3%</b>                   |

**Table 8. Driver and Passenger Seat Belt Use by Time of Day (n & unweighted %)**

|                | <b>Drivers<br/>Belted</b> | <b>Total<br/>Drivers</b> | <b>Passengers<br/>Belted</b> | <b>Total<br/>Passengers</b> | <b>% Drivers<br/>Belted</b> | <b>% Passengers<br/>Belted</b> |
|----------------|---------------------------|--------------------------|------------------------------|-----------------------------|-----------------------------|--------------------------------|
| 7AM to 759AM   | 241                       | 292                      | 26                           | 35                          | 82.3%                       | 74.9%                          |
| 8AM to 859AM   | 198                       | 271                      | 44                           | 58                          | 73.0%                       | 76.1%                          |
| 9AM to 959AM   | 783                       | 1,009                    | 160                          | 186                         | 77.6%                       | 86.2%                          |
| 10AM to 1059AM | 918                       | 1,121                    | 318                          | 369                         | 81.9%                       | 86.2%                          |
| 11AM to 1159AM | 1,354                     | 1,638                    | 458                          | 564                         | 82.6%                       | 81.2%                          |
| 12PM to 1259PM | 1,078                     | 1,431                    | 249                          | 345                         | 75.3%                       | 72.1%                          |
| 1PM to 159PM   | 1,131                     | 1,453                    | 281                          | 366                         | 77.8%                       | 76.8%                          |
| 2PM to 259PM   | 1,130                     | 1,394                    | 360                          | 471                         | 81.1%                       | 76.4%                          |
| 3PM to 359PM   | 814                       | 997                      | 235                          | 273                         | 81.6%                       | 85.8%                          |
| 4PM to 459PM   | 648                       | 843                      | 82                           | 116                         | 76.9%                       | 70.8%                          |
| 5PM to 559PM   | 1,018                     | 1,259                    | 147                          | 191                         | 80.8%                       | 76.8%                          |
| <b>Total</b>   | <b>9,313</b>              | <b>11,709</b>            | <b>2,360</b>                 | <b>2,975</b>                | <b>79.5%</b>                | <b>79.3%</b>                   |

**Table 9. Sample Weights and Seat Belt Use by Observation Site: Part B Reporting Data (n)**

| Site ID | Site Type | Dates Observed    | Sample Weight | Number of Drivers | Number of Front Passengers | Number of Occupants Belted | Number of Occupants Unbelted | Number of Occupants Unknown Use |
|---------|-----------|-------------------|---------------|-------------------|----------------------------|----------------------------|------------------------------|---------------------------------|
| 1001    | Original  | 8/23/19           | 2.62          | 40                | 12                         | 40                         | 11                           | 1                               |
| 1002    | Original  | 8/23/19           | 1.56          | 25                | 6                          | 23                         | 7                            | 1                               |
| 1003    | Original  | 8/23/19           | 3.59          | 435               | 247                        | 591                        | 86                           | 5                               |
| 1004    | Original  | 8/23/19           | 39.26         | 420               | 114                        | 292                        | 240                          | 2                               |
| 1005    | Original  | 8/23/19           | 1.02          | 435               | 226                        | 496                        | 162                          | 3                               |
| 1006    | Original  | 8/23/19           | 7.32          | 213               | 45                         | 192                        | 64                           | 2                               |
| 2001    | Original  | 8/22/19           | 8.78          | 91                | 18                         | 83                         | 26                           | 0                               |
| 2002    | Original  | 8/22/19           | 3.69          | 88                | 34                         | 108                        | 11                           | 3                               |
| 2003    | Original  | 8/22/19           | 3.62          | 40                | 8                          | 30                         | 17                           | 1                               |
| 2004    | Original  | 8/22/19           | 7.92          | 119               | 36                         | 90                         | 65                           | 0                               |
| 2005    | Original  | 8/22/19           | 1.35          | 126               | 68                         | 172                        | 20                           | 2                               |
| 2006    | Original  | 8/22/19           | 2.72          | 120               | 74                         | 152                        | 39                           | 3                               |
| 3001    | Original  | 8/21 & 12/27/2019 | 4.86          | 213               | 53                         | 194                        | 45                           | 27                              |
| 3002    | Original  | 8/21 & 12/27/2019 | 10.97         | 157               | 45                         | 156                        | 33                           | 13                              |
| 3003    | Original  | 8/21 & 12/27/2019 | 5.32          | 197               | 66                         | 201                        | 49                           | 13                              |
| 3004    | Original  | 8/21 & 12/27/2019 | 15.31         | 121               | 30                         | 111                        | 27                           | 13                              |
| 3005    | Original  | 8/21 & 12/27/2019 | 11.52         | 33                | 0                          | 24                         | 5                            | 4                               |
| 3006    | Original  | 8/21 & 12/27/2019 | 388.91        | 239               | 52                         | 219                        | 62                           | 10                              |
| 4001    | Original  | 8/20 & 12/29/2019 | 134.31        | 48                | 12                         | 55                         | 5                            | 0                               |
| 4002    | Original  | 8/20 & 12/27/2019 | 3.19          | 418               | 65                         | 412                        | 58                           | 13                              |
| 4003    | Original  | 8/20 & 12/27/2019 | 25.70         | 482               | 63                         | 451                        | 71                           | 23                              |
| 4004    | Original  | 8/20 & 12/28/2019 | 49.44         | 6                 | 2                          | 8                          | 0                            | 0                               |
| 4005    | Original  | 8/20 & 12/29/2019 | 96.21         | 6                 | 0                          | 6                          | 0                            | 0                               |
| 4006    | Original  | 8/20 & 12/28/2019 | 112.17        | 204               | 17                         | 187                        | 32                           | 2                               |
| 4007    | Original  | 8/15 & 12/29/2019 | 3.82          | 432               | 164                        | 504                        | 74                           | 18                              |
| 4008    | Original  | 8/15/19           | 67.28         | 2                 | 0                          | 1                          | 1                            | 0                               |
| 4009    | Original  | 8/15/19           | 84.55         | 6                 | 1                          | 5                          | 2                            | 0                               |
| 4010    | Original  | 8/15/19           | 98.43         | 4                 | 1                          | 4                          | 1                            | 0                               |
| 4011    | Original  | 8/15 & 12/29/2019 | 32.06         | 19                | 6                          | 20                         | 3                            | 2                               |
| 4012    | Original  | 8/15/19           | 1.25          | 867               | 91                         | 797                        | 118                          | 43                              |
| 4013    | Original  | 8/14/19           | 0.92          | 452               | 9                          | 339                        | 88                           | 34                              |
| 4014    | Original  | 8/14 & 12/28/2019 | 96.92         | 24                | 6                          | 20                         | 10                           | 0                               |
| 4015    | Original  | 8/14 & 12/28/2019 | 153.11        | 5                 | 0                          | 4                          | 1                            | 0                               |
| 4016    | Original  | 8/14/19           | 2.30          | 442               | 25                         | 336                        | 105                          | 26                              |
| 4017    | Original  | 8/14 & 12/29/2019 | 72.34         | 372               | 96                         | 386                        | 71                           | 11                              |
| 4018    | Original  | 8/14/19           | 158.17        | 4                 | 0                          | 2                          | 2                            | 0                               |
| 5001    | Original  | 8/17/19           | 6.02          | 25                | 6                          | 23                         | 8                            | 0                               |
| 5002    | Original  | 8/17/19           | 20.94         | 48                | 26                         | 65                         | 9                            | 0                               |
| 5003    | Original  | 8/17/19           | 18.00         | 94                | 35                         | 95                         | 32                           | 2                               |
| 5004    | Original  | 8/17/19           | 79.91         | 87                | 30                         | 66                         | 49                           | 2                               |
| 5005    | Original  | 8/17/19           | 11.93         | 6                 | 2                          | 5                          | 3                            | 0                               |
| 5006    | Original  | 8/17/19           | 20.42         | 6                 | 1                          | 5                          | 2                            | 0                               |



| Site ID       | Site Type | Dates Observed    | Sample Weight | Number of Drivers | Number of Front Passengers | Number of Occupants Belted | Number of Occupants Unbelted | Number of Occupants Unknown Use |
|---------------|-----------|-------------------|---------------|-------------------|----------------------------|----------------------------|------------------------------|---------------------------------|
| 6001          | Original  | 8/12 & 12/30/2019 | 7.54          | 15                | 6                          | 14                         | 6                            | 1                               |
| 6002          | Original  | 8/12 & 12/30/2019 | 29.32         | 42                | 8                          | 40                         | 9                            | 1                               |
| 6003          | Original  | 8/12 & 12/30/2019 | 21.48         | 4                 | 1                          | 4                          | 1                            | 0                               |
| 6004          | Original  | 8/12 & 12/31/2019 | 2.44          | 404               | 81                         | 412                        | 65                           | 8                               |
| 6005          | Original  | 8/12 & 12/26/2019 | 59.48         | 48                | 6                          | 45                         | 7                            | 2                               |
| 6006          | Original  | 8/12 & 12/26/2019 | 37.16         | 12                | 0                          | 11                         | 1                            | 0                               |
| 6007          | Original  | 8/18 & 12/29/2019 | 13.79         | 92                | 20                         | 87                         | 21                           | 4                               |
| 6008          | Original  | 8/18/2019         | 151.93        | 8                 | 3                          | 7                          | 4                            | 0                               |
| 6009          | Original  | 8/18/2019         | 2.43          | 227               | 90                         | 285                        | 29                           | 3                               |
| 6010          | Original  | 8/18/2019         | 0.64          | 333               | 145                        | 429                        | 47                           | 2                               |
| 6011          | Original  | 8/18 & 12/26/2019 | 72.24         | 9                 | 2                          | 9                          | 2                            | 0                               |
| 6012          | Original  | 8/18 & 12/26/2019 | 30.15         | 660               | 195                        | 772                        | 76                           | 7                               |
| 7001          | Original  | 8/12 & 12/27/2019 | 5.08          | 250               | 43                         | 235                        | 55                           | 3                               |
| 7002          | Original  | 8/12 & 12/27/2019 | 6.73          | 298               | 61                         | 253                        | 104                          | 2                               |
| 7003          | Original  | 8/12 & 12/27/2019 | 7.22          | 98                | 27                         | 85                         | 40                           | 0                               |
| 7004          | Original  | 8/12 & 12/27/2019 | 19.36         | 29                | 11                         | 26                         | 14                           | 0                               |
| 7005          | Original  | 8/12 & 12/27/2019 | 21.57         | 221               | 51                         | 187                        | 79                           | 6                               |
| 7006          | Original  | 8/12 & 12/27/2019 | 3.31          | 349               | 84                         | 304                        | 121                          | 8                               |
| 8001          | Alternate | 8/30/2019         | 17.67         | 219               | 66                         | 273                        | 9                            | 3                               |
| 8002          | Original  | 8/16 & 12/27/2019 | 108.16        | 22                | 7                          | 23                         | 6                            | 0                               |
| 8003          | Original  | 8/16 & 12/29/2019 | 16.90         | 361               | 82                         | 379                        | 58                           | 6                               |
| 8004          | Original  | 8/16/2019         | 55.02         | 19                | 2                          | 19                         | 2                            | 0                               |
| 8005          | Original  | 8/16 & 12/28/2019 | 166.04        | 28                | 6                          | 31                         | 3                            | 0                               |
| 8006          | Original  | 8/16 & 12/28/2019 | 136.22        | 18                | 7                          | 22                         | 3                            | 0                               |
| 9001          | Original  | 8/20/2019         | 9.49          | 169               | 87                         | 224                        | 27                           | 5                               |
| 9002          | Original  | 8/20 & 12/29/2019 | 21.08         | 105               | 24                         | 83                         | 40                           | 6                               |
| 9003          | Original  | 8/20/2019         | 13.39         | 13                | 2                          | 14                         | 1                            | 0                               |
| 9004          | Original  | 8/20 & 12/29/2019 | 4.06          | 209               | 32                         | 193                        | 27                           | 21                              |
| 9005          | Original  | 8/20 & 12/29/2019 | 4.13          | 185               | 20                         | 158                        | 27                           | 20                              |
| 9006          | Original  | 8/20/2019         | 20.37         | 91                | 14                         | 79                         | 19                           | 7                               |
| <b>TOTALS</b> |           |                   |               | <b>11,709</b>     | <b>2,975</b>               | <b>11,673</b>              | <b>2,617</b>                 | <b>394</b>                      |

Appendix A. Observation Site Form 2019

# Nebraska Seat Belt Survey

## Site Form

Data Collector: \_\_\_\_\_

Date: \_\_\_\_ / \_\_\_\_ / 2019

### Site Identification:

|                           |                                       |
|---------------------------|---------------------------------------|
| County: «County»          | ID:                                   |
| Road Name: «Road_name911» | County Site #:<br>«County_map_inset_» |

### Site Start and End Time:

|   |
|---|
| Start time for observations: _____ am/pm                |
| End time for observations: _____ am/pm                  |
| (Total observation period MUST last exactly 45 minutes) |

### Site Description:

|  |
|--|
| Selected traffic flow direction: North South East West   |
| Total number of lanes in selected direction: _____       |
| Weather Conditions: Clear Cloudy/PC Light Fog Light Rain |

### Alternate Site Information:

|  |    |     |
|--|----|-----|
| Is this an alternate site (not including a recommended observation point)? | No | Yes |
| If yes, why was an alternate site needed?<br>_____                         |    |     |

### Traffic Count:

|   |    |     |
|---|----|-----|
| Is a traffic count required (exit ramp or rest stop)? | No | Yes |
| If yes,<br>Number of Cars: _____ Duration: _____      |    |     |

**Appendix B. Observation Count Form 2019**

**Nebraska Seat Belt Survey – Observation Count Form**

County: \_\_\_\_\_

Page \_\_\_ of \_\_\_

County site #: \_\_\_\_\_

ID #: \_\_\_\_\_

Data Collector ID# \_\_\_\_\_

**Responses: Y = Yes, N = No, U = Unknown, NP = No Passenger**

| VEHICLE NUMBER | DRIVER SEATBELT USE |   |   | PASSENGER SEATBELT USE |   |   |    |
|----------------|---------------------|---|---|------------------------|---|---|----|
|                | Y                   | N | U | Y                      | N | U | NP |
| 1              | Y                   | N | U | Y                      | N | U | NP |
| 2              | Y                   | N | U | Y                      | N | U | NP |
| 3              | Y                   | N | U | Y                      | N | U | NP |
| 4              | Y                   | N | U | Y                      | N | U | NP |
| 5              | Y                   | N | U | Y                      | N | U | NP |
| 6              | Y                   | N | U | Y                      | N | U | NP |
| 7              | Y                   | N | U | Y                      | N | U | NP |
| 8              | Y                   | N | U | Y                      | N | U | NP |
| 9              | Y                   | N | U | Y                      | N | U | NP |
| 10             | Y                   | N | U | Y                      | N | U | NP |
| 11             | Y                   | N | U | Y                      | N | U | NP |
| 12             | Y                   | N | U | Y                      | N | U | NP |
| 13             | Y                   | N | U | Y                      | N | U | NP |
| 14             | Y                   | N | U | Y                      | N | U | NP |
| 15             | Y                   | N | U | Y                      | N | U | NP |
| 16             | Y                   | N | U | Y                      | N | U | NP |
| 17             | Y                   | N | U | Y                      | N | U | NP |
| 18             | Y                   | N | U | Y                      | N | U | NP |
| 19             | Y                   | N | U | Y                      | N | U | NP |
| 20             | Y                   | N | U | Y                      | N | U | NP |
| 21             | Y                   | N | U | Y                      | N | U | NP |
| 22             | Y                   | N | U | Y                      | N | U | NP |
| 23             | Y                   | N | U | Y                      | N | U | NP |
| 24             | Y                   | N | U | Y                      | N | U | NP |
| 25             | Y                   | N | U | Y                      | N | U | NP |
| 26             | Y                   | N | U | Y                      | N | U | NP |
| 27             | Y                   | N | U | Y                      | N | U | NP |
| 28             | Y                   | N | U | Y                      | N | U | NP |
| 29             | Y                   | N | U | Y                      | N | U | NP |
| 30             | Y                   | N | U | Y                      | N | U | NP |
| 31             | Y                   | N | U | Y                      | N | U | NP |
| 32             | Y                   | N | U | Y                      | N | U | NP |
| 33             | Y                   | N | U | Y                      | N | U | NP |
| 34             | Y                   | N | U | Y                      | N | U | NP |
| 35             | Y                   | N | U | Y                      | N | U | NP |
| 36             | Y                   | N | U | Y                      | N | U | NP |
| 37             | Y                   | N | U | Y                      | N | U | NP |
| 38             | Y                   | N | U | Y                      | N | U | NP |
| 39             | Y                   | N | U | Y                      | N | U | NP |
| 40             | Y                   | N | U | Y                      | N | U | NP |

| VEHICLE NUMBER | DRIVER SEATBELT USE |   |   | PASSENGER SEATBELT USE |   |   |    |
|----------------|---------------------|---|---|------------------------|---|---|----|
|                | Y                   | N | U | Y                      | N | U | NP |
| 41             | Y                   | N | U | Y                      | N | U | NP |
| 42             | Y                   | N | U | Y                      | N | U | NP |
| 43             | Y                   | N | U | Y                      | N | U | NP |
| 44             | Y                   | N | U | Y                      | N | U | NP |
| 45             | Y                   | N | U | Y                      | N | U | NP |
| 46             | Y                   | N | U | Y                      | N | U | NP |
| 47             | Y                   | N | U | Y                      | N | U | NP |
| 48             | Y                   | N | U | Y                      | N | U | NP |
| 49             | Y                   | N | U | Y                      | N | U | NP |
| 50             | Y                   | N | U | Y                      | N | U | NP |
| 51             | Y                   | N | U | Y                      | N | U | NP |
| 52             | Y                   | N | U | Y                      | N | U | NP |
| 53             | Y                   | N | U | Y                      | N | U | NP |
| 54             | Y                   | N | U | Y                      | N | U | NP |
| 55             | Y                   | N | U | Y                      | N | U | NP |
| 56             | Y                   | N | U | Y                      | N | U | NP |
| 57             | Y                   | N | U | Y                      | N | U | NP |
| 58             | Y                   | N | U | Y                      | N | U | NP |
| 59             | Y                   | N | U | Y                      | N | U | NP |
| 60             | Y                   | N | U | Y                      | N | U | NP |
| 61             | Y                   | N | U | Y                      | N | U | NP |
| 62             | Y                   | N | U | Y                      | N | U | NP |
| 63             | Y                   | N | U | Y                      | N | U | NP |
| 64             | Y                   | N | U | Y                      | N | U | NP |
| 65             | Y                   | N | U | Y                      | N | U | NP |
| 66             | Y                   | N | U | Y                      | N | U | NP |
| 67             | Y                   | N | U | Y                      | N | U | NP |
| 68             | Y                   | N | U | Y                      | N | U | NP |
| 69             | Y                   | N | U | Y                      | N | U | NP |
| 70             | Y                   | N | U | Y                      | N | U | NP |
| 71             | Y                   | N | U | Y                      | N | U | NP |
| 72             | Y                   | N | U | Y                      | N | U | NP |
| 73             | Y                   | N | U | Y                      | N | U | NP |
| 74             | Y                   | N | U | Y                      | N | U | NP |
| 75             | Y                   | N | U | Y                      | N | U | NP |
| 76             | Y                   | N | U | Y                      | N | U | NP |
| 77             | Y                   | N | U | Y                      | N | U | NP |
| 78             | Y                   | N | U | Y                      | N | U | NP |
| 79             | Y                   | N | U | Y                      | N | U | NP |
| 80             | Y                   | N | U | Y                      | N | U | NP |

This document summarizes estimation and variance estimation procedures for the 2019 seat belt survey in Nebraska. The main result is that the estimated seat-belt use rate for 2019 is approximately 10 percentage points lower than the 2018 estimate, and the estimated standard error for 2019 is approximately triple the 2018 standard error. The provided documentation for the 2017-2018 surveys is unclear about the procedures for Douglas and Lancaster counties. In this document, we explain our understanding of the procedures used for the 2017-2018 surveys, and we explain the methods that we use to construct estimation weights and variance estimates for the 2019 survey.

## 1 Summary of Nebraska Sample Design for 2017-2022 Surveys

The road segments to be included in the Nebraska samples for 2017-2022 are selected according to a stratified 2-stage design. The first stage sample of counties is selected using with replacement sampling, where the probability is related to the total vehicle miles traveled in the county. In the second stage, a sample of road segments is selected from each sampled county using stratified probability proportional to size with replacement sampling, where the strata are road types and the size measure is the road segment length. All counties except for Douglas and Lancaster counties have six sampled road segments. Douglas and Lancaster counties are over-sampled, as described below in more detail.

A preliminary probability for each county  $i$  is calculated as

$$\pi_i = \frac{9V_i}{T_v},$$

where  $V_i$  is the 2014 vehicle miles traveled for county  $i$ . Table 2 of the Nebraska sampling document provides  $V_i$  for all counties except for Seward County. We obtain a value of  $V_i = 384.36$  for Seward County from <https://dot.nebraska.gov/media/6672/2014annualvehiclemiles.pdf>.

Douglas County and Lancaster County have  $\pi_i > 1$  and are included with certainty. Oversampling these two large counties is reasonable, but the particular way in which these

counties are over-sampled seems somewhat odd. These two counties are included in the with-replacement scheme with a draw probability proportional to  $\pi_i - k_i$ , where  $k_i$  is the greatest integer smaller than  $\pi_i$ .

Define

$$S_i = \begin{cases} \pi_i & \text{if not Lancaster or Douglas County} \\ \pi_i - k_i & \text{if Lancaster or Douglas County.} \end{cases}$$

The with-replacement draw probability is then  $S_i / \sum_{i \in U} S_i$ , where  $U$  denotes the collection of counties included in the frame for selection. The number of draws is 9.

For all counties except for Douglas and Lancaster counties, six secondary road segments are selected. Douglas and Lancaster counties are over-sampled, and the ultimate sample size for these two counties depends on the number of times that they are selected in the with-replacement scheme. The number of road segments selected from a county is  $6(Q_i + I[\text{Lancaster County}] + I[\text{Douglas County}])$ , where  $Q_i$  is the number of times that the county is selected in the with-replacement selection scheme. For Douglas County,  $Q_i = 2$ , and for Lancaster County  $Q_i = 1$ . Therefore, the sample sizes for Douglas and Lancaster counties are 18 and 12, respectively.

Within each county, a stratified sample of road segments is selected using stratified systematic probability proportional to size sampling. The three road strata are primary, secondary, and local roads. Road segments are allocated to strata within each county using proportional allocation based on road segment length. The road segment length is also the size measure for probability proportional to size sampling. Let  $\pi_{j|i}$  denote the conditional probability of selecting road segment  $j$  given that county  $i$  is selected.

## 2 Weights and Point Estimators of Seat Belt Use Rates

Using the 2018 Nebraska report, we were able to determine that the column labeled “Selection.Probability” in the provided spreadsheet contains the inverse of the estimation weights used for 2018 for road segments in the 2018 sample. Based on the documentation provided,

we think that the column labeled “Selection.Probability” contains the quantities

$$\tilde{\pi}_{ij} = \pi_i \pi_{j|i},$$

where the  $\pi_i$  values for Douglas and Lancaster counties are greater than 1. We define an initial weight for all counties except for Douglas and Lancaster by

$$w_{ij}^{(0)} = \left( \frac{\pi_{ij}}{\pi_i} \right)^{-1} \tilde{\pi}_i^{-1},$$

where

$$\tilde{\pi}_i = \frac{7V_i}{T_v - V_{\text{Douglas}} - V_{\text{Lancaster}}}.$$

The initial weight for Douglas and Lancaster counties is defined

$$w_{ij}^{(0)} = \left( \frac{\pi_{ij}}{\pi_i} \right)^{-1}.$$

We ratio adjust the weights  $w_{ij}^{(0)}$  to preserve the county level vehicle miles traveled. The ratio adjusted weight is defined as

$$w_{ij} = \frac{w_{ij}^{(0)} V_i}{\sum_{j \in A_i} w_{ij}^{(0)} (L_{ij} C_{ij})},$$

where  $L_{ij}$  is the length of road segment  $j$  in county  $i$ ,  $C_{ij}$  is the the vehicle count for the road segment. The vehicle count is defined

$$C_{ij} = \begin{cases} C_{ij, \text{Aug}19} & \text{if segment only observed in August 2019} \\ (C_{ij, \text{Aug}19} + C_{ij, \text{Dec}19})/2 & \text{otherwise,} \end{cases} \quad (1)$$

where  $C_{ij,t}$  is the number of vehicles observed on the road segment during data collection at time period  $t$ .

Denote the estimates of the seat belt use rates for drivers, passengers, and total occupants by  $\hat{p}_d$ ,  $\hat{p}_p$ , and  $\hat{p}$ , respectively. The estimates of the seat belt use rates are defined by

$$\hat{p}_d = \frac{\sum_{i \in A} \sum_{j \in A_i} w_{ij} b_{d,ij}}{\sum_{i \in A} w_{ij} (b_{d,ij} + u_{d,ij})}$$

$$\hat{p}_p = \frac{\sum_{i \in A} \sum_{j \in A_i} w_{ij} b_{p,ij}}{\sum_{i \in A} \sum_{j \in A_i} w_{ij} (b_{p,ij} + u_{p,ij})},$$

and

$$\hat{p} = \frac{\sum_{i \in A} \sum_{j \in A_i} w_{ij} b_{ij}}{\sum_{i \in A} \sum_{j \in A_i} w_{ij} (b_{ij} + u_{ij})},$$

where  $A$  denotes the sample of counties,  $A_i$  denotes the sample of road segments in county  $i$ ,  $b_{d,ij}$  denotes the number of belted drivers,  $b_{p,ij}$  denotes the number of belted passengers,  $u_{d,ij}$  denotes the number of unbelted drivers, and  $u_{p,ij}$  denotes the number of unbelted passengers in vehicles observed for road segment  $j$  of county  $i$ . In the definition of  $\hat{p}$ ,  $b_{ij} = b_{d,ij} + b_{p,ij}$ , and  $u_{ij} = u_{d,ij} + u_{p,ij}$ .

### 3 Variance Estimation

The main idea of the variance estimator is to estimate the conditional variance, given the number of times that Douglas and Lancaster counties are selected. This conditions on the (random) sample sizes for these counties. In the Appendix, we summarize a brief simulation study that supports this procedure.

We define a set of replicate weights for variance estimation. The sample has nine total counties, including Lancaster and Douglas counties. We label the seven counties that are not Lancaster or Douglas with the numbers 1-7. We label Douglas and Lancaster counties with the numbers 8 and 9, respectively. For  $k = 1, \dots, 7$ , we define a replicate weight by

$$\tilde{r}_{ij}^{(k)} = \begin{cases} 0 & \text{if } i = k \\ w_{ij} 7/6 & \text{if } i \neq k, i \leq 7 \\ w_{ij} & \text{if } i > 7. \end{cases}$$

We define 18 replicates for Douglas County and 12 replicates for Lancaster county. Let  $n(ij)$  denote the number of road segments in the county  $i$  sample for the stratum  $h(ij)$  that contains road segment  $j$ . Label the 18 road segments in Douglas County by  $j = 1, \dots, 18$ . For  $k = 8, \dots, 25$ , define a replicate weight by

$$\tilde{r}_{ij}^{(k)} = \begin{cases} 0 & \text{if } i = 8, j = k - 7 \\ w_{ij} \frac{n(ij)}{n(ij)-1} & \text{if } i = 8, j \neq k - 7, h(ij) = h(i(k-7)) \\ w_{ij} & \text{if } i \neq 8 \text{ or } i = 8 \text{ and } h(ij) \neq h(i(k-7)). \end{cases}$$

Label the 12 road segments in Lancaster county by  $j = 1, \dots, 12$ . For  $k = 26, \dots, 37$ , define

$$\tilde{r}_{ij}^{(k)} = \begin{cases} 0 & \text{if } i = 9, j = k - 25 \\ w_{ij} \frac{n(ij)}{n(ij)-1} & \text{if } i = 9, j \neq k - 25, h(ij) = h(i(k - 25)) \\ w_{ij} & \text{if } i \neq 9 \text{ or } i = 9 \text{ and } h(ij) \neq h(i(k - 25)). \end{cases}$$

The final replicate weight  $r_{ij}^{(k)}$  is defined by ratio adjusting the  $\tilde{r}_{ij}^{(k)}$  to the county vehicle miles traveled. Specifically,

$$r_{ij}^{(k)} = \frac{\tilde{r}_{ij}^{(k)} V_i}{\sum_{j \in A_i} \tilde{r}_{ij}^{(k)} (L_{ij} C_{ij})}.$$

The estimated standard error is defined as

$$SE(\hat{p}) = \sqrt{\hat{V}\{\hat{p}\}},$$

where  $\hat{V}\{\hat{p}\} = \sum_{k=1}^K (\hat{p}^{(k)} - \hat{p})^2$ , and

$$\hat{p}^{(k)} = \frac{\sum_{i \in A} \sum_{j \in A_i} r_{ij}^{(k)} b_{ij}}{\sum_{i \in A} \sum_{j \in A_i} r_{ij}^{(k)} (b_{ij} + u_{ij})}.$$

For this definition of the replicates,  $\hat{p} = 37^{-1} \sum_{k=1}^{37} \hat{p}^{(k)}$ .

## 4 Results

Below, we present the estimates for 2019 corresponding to the tables included in the 2018 report.

Table 1: Nebraska Safety Belt Use

| Sample Division | N     | 2019 Belted Estimate<br>(S.E. in Parentheses) | 95% CI Lower | 95% CI Upper |
|-----------------|-------|---|--------------|--------------|
| Total Sample    | 14684 | 0.797<br>(0.023)                              | 0.754        | 0.842        |
| Drivers         | 11709 | 0.800<br>(0.022)                              | 0.756        | 0.844        |
| Passengers      | 2975  | 0.785<br>(0.030)                              | 0.726        | 0.843        |



Table 2: Safety Belt Use 2019

| <b>Sample Division</b> | <b>2019 Belted Estimate</b><br><b>(S.E. in Parentheses)</b> |
|------------------------|---|
| Total Sample           | 0.797<br>(0.023)  |
| Drivers                | 0.800<br>(0.022)  |
| Passengers             | 0.785<br>(0.030)  |

Table 3: **Weighted Belt Use By County – Percent Belted**

|           | <b>N (2019)</b> | <b>2019 Belted Estimate</b> |
|-----------|-----------------|-----------------------------|
| Buffalo   | 2218            | 0.601                       |
| Cheyenne  | 822             | 0.726                       |
| Dodge     | 1206            | 0.781                       |
| Douglas   | 4351            | 0.848                       |
| Holt      | 366             | 0.643                       |
| Lancaster | 2411            | 0.882                       |
| Otoe      | 1522            | 0.713                       |
| Sarpy     | 837             | 0.891                       |
| Seward    | 951             | 0.805                       |

Table 4: **2019 Weighted and Unweighted Belt Use Estimates by Road Types**

| <b>Road Type</b> | <b>N (2019)</b> | <b>Weighted</b> | <b>Unweighted</b> |
|------------------|-----------------|-----------------|-------------------|
| Local            | 1226            | 0.85            | 0.84              |
| Primary          | 5090            | 0.89            | 0.85              |
| Secondary        | 8368            | 0.77            | 0.79              |

## 4.1 Comparison of August 2019 Estimates and December 2019 Estimates

We compare the August 2019 estimates to the December 2019 estimates in Table 5. A t-statistic for the null hypothesis mean difference between December 2019 and August 2019 estimators is zero is -2.30. The estimators from the two time-points have significantly different means. The December 2019 data is more similar to the 2018 data, in terms of estimated belt use proportion.

|            | Estimate | SE    |
|------------|----------|-------|
| August     | 0.758    | 0.038 |
| December   | 0.848    | 0.013 |
| Difference | 0.090    | 0.039 |

Table 5: Comparison of estimates based on August 2019 data to estimates based on December 2019 data.

## 4.2 Alternative Parameter: Miles Belted

An alternative parameter is the proportion of belted miles driven, instead of the proportion of belted people. An estimator of the proportion of belted miles is

$$\hat{p}_{alt} = \frac{\sum_{i \in A} \sum_{j \in A_i} w_{ij} b_{ij} L_{ij} C_{ij}}{\sum_{i \in A} \sum_{j \in A_i} (b_{ij} + u_{ij}) w_{ij} L_{ij} C_{ij}}.$$

The estimate and standard error of the proportion of belted miles is 82.5% and 2.0%, respectively.

## Appendix: Simulation

We conduct a limited simulation study to validate the estimation and variance estimation procedures. We generate a population of 102 clusters, each with 100 population elements. We assign values to the 10200 population elements as independently generated standard normal random variables. We assign size measures to the first 100 clusters as independently

generated  $\chi_{(1)}^2$  random variables. We define a preliminary inclusion probability for clusters  $1, \dots, 100$  by

$$\pi_i = \frac{12S_i}{\sum_{i=1}^{100} S_i},$$

where  $S_i$  is the assigned size measure. We set  $\pi_{101} = 1.6$  and  $\pi_{102} = 2.8$ . We then define draw probabilities for with-replacement sampling of clusters by  $p_i = \pi_i / (\sum_{j=1}^{102} \pi_j)$  for  $i = 1, \dots, 102$ . We select a probability proportional to size sample of clusters with 12 draws. We select a simple random sample from each sampled cluster. The second-stage sample size is 10 for clusters 1-100, and the second stage sample size is  $10 + 5Q_i$  for  $i = 101, 102$ , where  $Q_i$  is the number of times that cluster  $i$  is selected in the second stage. We define an estimation weight for element  $j$  in cluster  $i$  as

$$w_{ij} = \begin{cases} 100/10/(12p_i) & \text{if } i \leq 100 \\ 100/(10 + 5Q_i) & \text{if } i > 100. \end{cases}$$

We consider two variance estimates. The first uses an analytical expression. The second is a replication variance estimator.

We let  $\hat{V}_A$  denote an estimate of the variance obtained using an analytical formula as the sum of the between-cluster variance for sampled clusters with  $i < 101$  and the within-cluster variance for clusters 101 and 102. Let  $1, \dots, \tilde{m}$  denote draws on which clusters with labels less than 101 are selected. The analytic variance formula is defined as

$$\hat{V}_A = \hat{V}_{A1} + \hat{V}_{A2} + \hat{V}_{A3},$$

where

$$\begin{aligned} \hat{V}_{A1} &= \frac{1}{\tilde{m}} \sum_{i=1}^{\tilde{m}} (Z_i - \bar{Z})^2, \\ \hat{V}_{A2} &= 100^2 \left(1 - \frac{10 + 5Q_{101}}{100}\right)^2 s_{101}^2 / (10 + 5Q_{101}) \\ \hat{V}_{A3} &= 100^2 \left(1 - \frac{10 + 5Q_{102}}{100}\right)^2 s_{102}^2 / (10 + 5Q_{102}), \end{aligned}$$

$Z_i = 100\bar{y}_i/\tilde{p}_i$ ,  $\bar{y}_i$  is the simple mean of the sampled observations for the cluster selected on draw  $i$ ,

$$\tilde{p}_i = \frac{p_i}{\sum_{i=1}^{100} p_i},$$

$\bar{Z} = \tilde{m}^{-1} \sum_{i=1}^{\tilde{m}} Z_i$ , and  $s_i^2$  is the sample variance of the observations sampled in cluster  $i$ .

For the jackknife variance estimator, we define  $120 + 5 \sum_{i=101}^{102} Q_i$  replicates in a manner analogous to the procedure described for the Nebraska survey. The method of defining replicates for the simulation is identical to the procedure used for the Nebraska survey except that we do not need to account for strata within clusters. We denote the jackknife variance estimator by  $\hat{V}_{J1}$ .

We estimate the finite population total for 100,000 samples. A  $t$ -statistic for the bias of the point estimator is -0.56. The ratio of the MC mean of  $\hat{V}_A$  to the MC variance of the estimator is 1.053. The ratio of the MC mean of  $\hat{V}_{J1}$  to the MC variance of the estimator is 1.059.