2024 STATEWIDE OBSERVATIONAL SURVEY OF SEAT BELT USE IN TENNESSEE

FINAL REPORT

Submitted by
MATTHEW CATE, P.E.
RESEARCH LEADER I

THE UNIVERSITY OF TENNESSEE KNOXVILLE
CENTER FOR TRANSPORTATION RESEARCH

Submitted to
TENNESSEE HIGHWAY SAFETY OFFICE

TENNESSEE HIGHWAY SAFETY OFFICE
helping you ARRIVE

October 28, 2024

Executive Summary

The University of Tennessee Center for Transportation Research (CTR) gathered data for the 2024 Statewide Observational Survey of Seat Belt Use in Tennessee in March, April, and May. This survey was conducted in full compliance with NHTSA's Uniform Criteria for State Observational Surveys of Seat Belt Use. The 2024 survey returned a statewide seat belt use rate of 92.2%, an increase of approximately 0.2% over the 2023 survey average use rate of 92.0%. Additionally, the 2024 survey result is the highest average belt use recorded in Tennessee, surpassing the previous high mark of 92.0% in 2023.

Table of Contents

Introduction

Since 1986, The University of Tennessee Center for Transportation Research (CTR) has conducted a statewide observational survey of seat belt use at least once each year. These survey efforts have documented the seat belt use behavior of Tennesseans throughout this period time, beginning with an initial usage rate of only 26% in 1986 and peaking at 92.2% in 2024. These survey results document the effectiveness of Tennessee's occupant protection education, enforcement, and outreach efforts and provide decision-makers with an accurate snapshot of the state's adult occupant protection needs and successes.

The observational survey sample design, data collection techniques, and estimation procedures summarized in this report have been developed under the National Highway Traffic Safety Administration's (NHTSA's) "Uniform Criteria for State Observational Survey of Seat Belt Use," published in the April 1, 2011, Federal Register (23 CRF Part 1340, pp. 18056-18059)[1]. Complete survey design and methodology details are included in Appendix 1 of this report.

Tennessee's current statewide observational survey design was approved by NHTSA in 2012. Under this design, the survey returns to the same observation sites in the same counties for at least five consecutive years. A scheduled five-year update of the survey sample was completed before the 2022 survey. This sample of observation sites was used for the third straight year for the 2024 observational survey.

Survey Design

A multi-stage area PPS (probability proportional to size) sampling approach is used in the proposed survey design. In the first stage, primary sampling units are PPS randomly selected. The primary sampling unit for the Tennessee survey is the county. Tennessee has a total of 95 counties. At the time of the initial county sample selection in 2012, 59 counties collectively accounted for 85% of the state's passenger vehicle occupant fatalities and, consistent with NHTSA guidelines, were considered eligible for inclusion in the final belt use design. They were the counties with the most passenger vehicle occupant fatalities in 2005-2009 except for Coffee County, whose 63 fatalities ranked it 17th among all counties at the time (Coffee County was 22nd among all counties using the 2018-2022 passenger vehicle fatality totals). In early June of each year, when the state seat belt use survey was traditionally collected, Coffee County hosts the Bonnaroo Music Festival, which brings roughly 100,000 young fans into the area. This crowd is atypical of normal Coffee County traffic and could distort the observed belt use rate. Therefore, Coffee County was excluded from the list of sampled counties.

Table 1 shows the current five-year (2018-2022) passenger vehicle (passenger cars, pickup trucks, sport utility vehicles, and vans) occupant fatality totals[2] and total estimated daily vehicle miles of travel (DVMT)[3] for each of the 16 survey counties. The survey sample includes the top six counties by total fatalities and no county within the sample is ranked lower than 59th. Collectively, the survey counties represent 48.15% of the state's 2018-2022 passenger vehicle occupant fatalities and 54.60% of Tennessee's total 2023 DVMT.

[1] https://www.federalregister.gov/documents/2011/04/01/2011-7632/uniform-criteria-for-state-observational-surveys-of-seat-belt-use

[2] "Tennessee Traffic Safety Facts 2018-2022." Traffic Safety Facts Annual Report Tables, National Highway Traffic Safety Administration, 23 Oct. 2024, https://cdan.dot.gov/STSI/stsi.htm#.

[3] "2023 HPMS DVMT Rural and Urban by County." Highway Performance Monitoring System, Tennessee Department of Transportation, 23 Oct. 2024, https://www.tn.gov/tdot/long-range-planning-home/longrange-road-inventory/longrange-road-inventory-highway-performance-monitoring-system.html.

Table 1: Characteristics of Sampled Tennessee Counties

	Passenger Car, Light Truck, and Van Occupant Fatalities									
County	2018	2019	2020	2021	2022	5-Year Total, 2018 - 2022	% TN Fatalities, 2018-2022	Fatality Rank, 2018-2022	2023 DVMT	% 2023 TN DVMT
Shelby	93	96	147	164	140	640	15.79%	1	24,615,944	10.72%
Davidson	41	53	60	76	75	305	7.52%	2	25,378,814	11.05%
Knox	46	44	33	49	37	209	5.16%	3	17,243,528	7.51%
Hamilton	22	38	31	31	33	155	3.82%	4	11,502,214	5.01%
Rutherford	21	21	33	22	30	127	3.13%	5	11,270,588	4.91%
Montgomery	14	16	14	18	16	78	1.92%	6	5,204,108	2.27%
Williamson	7	15	16	7	19	64	1.58%	12	9,109,267	3.97%
Blount	17	11	8	13	11	60	1.48%	13	3,614,476	1.57%
Sevier	5	19	14	14	7	59	1.46%	14	4,598,751	2.00%
McMinn	15	9	10	9	11	54	1.33%	17	2,309,208	1.01%
Roane	9	11	5	8	9	42	1.04%	26	2,222,535	0.97%
Marion	9	6	6	10	8	39	0.96%	28	2,261,122	0.98%
Loudon	9	7	6	7	8	37	0.91%	30	2,605,498	1.13%
Dyer	4	9	8	7	5	33	0.81%	34	1,369,084	0.60%
Tipton	6	7	3	4	10	30	0.74%	41	1,071,344	0.47%
Warren	3	4	5	2	6	20	0.49%	59	994,550	0.43%
Survey Counties	321	366	399	441	425	1952	48.15%		125,371,031	54.60%
State Total	683	779	814	901	877	4054	100.00%		229,597,752	100.00%

County Sample Selection

A sample of 16 counties was selected because Tennessee has a total of 59 counties in its sampling unit population. Based on recommendations from NHTSA's previous 23 CFR Part 1340 guidelines, this is an appropriate number to achieve the desired level of accuracy in belt use estimation.

The 16-county sample was selected using a two-step procedure. First, 4 counties (Shelby, Davidson, Knox, and Hamilton) were placed with certainty into the first tier of the 16-county sample. These counties are the largest in the state by several measures. They contain the four largest cities, and each has more population, passenger vehicle occupant fatalities, and DVMT than any other county.

12 additional counties were selected from the remaining 55 eligible counties to make up the second tier of the survey sample, with the probability for selection proportional to the county's DVMT. These counties had their DVMT percentages of the group of 55 ("p") multiplied by 12, the number remaining to be selected. No counties had $12 \times p > 1.0$, so all were eligible for PPS sampling without additional adjustments. The counties were randomly ordered, to eliminate sequential dependencies, and cumulative values of the DVMT percentages×12 were computed.

A random number from a rectangular distribution between 0 and 1.0 was drawn, and 12 counties were selected: the first county whose cumulative DVMT percentage×12 was equal to or greater than the random number, the first whose cumulative DVMT percentage×12 was equal to or greater than the (random number+1), …, and the first whose cumulative DVMT percentage×12 was equal to or greater than the (random number+11). This produced a total sample of 16 counties in two tiers. The four counties in Tier 1 had probability (selection) = 1.0; the remaining counties had probability (selection) = 12 times their DVMT proportion of the DVMT of the final group of 55 counties.

Road Segment Allocation

Once the 16 survey counties were selected, second-stage sampling of individual route segments in each of the counties was performed. The distribution of segments across counties and road functional class strata was done according to the following considerations.

The qualifying route segments comprising the sampling population were identified from the TRIMS road segment file. All route segments define the route segment population for each county. In the sampling, we would omit from consideration rural local road segments in counties not part of Census-defined Metropolitan Statistical Areas (MSAs) as well as road segments identified in the database as frontage roads and segments that are cul-de-sacs or other segment types which may be excluded according to NHTSA guidelines.

First, the route segments from each of the survey counties were stratified into the following five groups using TDOT functional classification data:

1. Interstates and Other Expressways
2. Other Principal Arterials
3. Minor Arterials
4. Collectors
5. Local Roads

In the sampling, we removed from consideration rural local road segments in counties not part of Census-defined Metropolitan Statistical Areas (MSAs) as well as road segments identified in the database as frontage roads and segments that are cul-de-sacs or other segment types which may be excluded according to NHTSA guidelines. Counts and DVMT values are from TRIMS and refer specifically to road segments that are available for sampling. Rural local roads in non-MSA counties are excluded. TRIMS contains DVMT measures for all roads that are collectors or larger but almost no DVMT values for local roads.

The distribution of segments across counties and road functional class strata was performed according to the following considerations.

1. The four counties in the first (certainty) tier of selection have three road segments selected in each road class stratum.
2. Most counties in the second (probabilistic) tier have road segments in each road class stratum. For those, allocate two segments in the four strata with more traffic and three in the Local Road stratum, providing the additional segment to give greater reliability to the county stratum likely to have fewer observations per segment.
3. Two counties (Tipton and Warren) in the probabilistic tier did not have interstates or other freeways at the time of their inclusion into the survey sample of counties. In these counties, a third site was allocated to Other Principal Arterials, the stratum with the largest DVMT.

Nearly one-third of the sample segments (60 segments) are allocated to the state's 4 largest counties, 15 each. The 12 smaller counties in the survey have 10 or 11 segments each, depending on their road type distributions. The result is a design with 190 total road segments.

Road Segment Sample Selection

Within each county-road type stratum, road segments were chosen with probability proportional to size (PPS). For the four strata with known DVMT, size was represented by segment DVMT. For the Local Road stratum, size was represented by segment length. The target number of segments selected was double the number of segments required to be observed.

The following steps were applied separately for each county-stratum "pool" of road segments:

1. Total the DVMT (or length) for the road segments in the county stratum. For each segment, calculate the percentage of its DVMT (length) of the total.
2. For each segment, multiply its DVMT (length) percentage by "n", the number of road segments to be selected, the required number of sites plus an equal number of alternates.
3. In the case of any segments with a DVMT (length) percentage × n ≥ 1, identified them as chosen with certainty (p = 1.0) and removed them from the pool. Then returned to Step 1, with a reduced number of segments and a reduced number of segments to be selected,
   n′ = n – (number already selected as certainty choices).
4. When there are no longer any segments with a DVMT (length) percentage × n (or n′) ≥ 1, continue to Step 5 to randomly select any segments yet to be selected.
5. Randomly order the segments in the county stratum to eliminate any sequential dependencies.
6. Compute cumulative percentages from the percentage of the first segment to 100% and multiplied the cumulative percentages by n or n′, the number of road segments yet to be selected.
7. Generated a random number from a rectangular distribution between 0 and 100%.
8. Accepted as observation segments the first segment whose cumulative percentage × n (or n′, in all cases) was equal to or greater than the random number, the first segment whose cumulative DVMT (length) percentage × n was equal to or greater than the (random number+1), … , and the first segment whose cumulative DVMT (length) percentage × n was equal to or greater than the (random number + n-1).
9. For any county stratum which includes certainty selections, randomly reorder all the selected segments.

The order of selection is preserved, the segments first selected are the first targets for use, and the remaining segments are designated as alternates. This process resulted in 190 segments for observation and 190 segments to be held in reserve as spares.

If one (or more) of the primary segments proves unusable in the field, e.g., due to temporary construction, and picking another observation site on the same segment will not solve the problem, the next alternate segment(s) in order (same county, same road stratum) will be substituted. In subsequent administrations of the survey, observation will resume at the original sites unless they are still unusable, in which case a replacement segment will be selected according to the procedures above.

Observation Site Selection

Before the first actual data collection, specific locations for data observations were selected, based on visits to the locations, maps, and/or online road-level images. At this time, the direction of travel to be observed was randomly determined for each segment/site. The direction chosen was used unless it required an unsafe observation location or something such as sun glare makes it extremely difficult to observe seat belt use.

Sites were selected for observer and traffic safety so that the observer has a clear view of the vehicles to be coded. Where possible, sites were selected at controlled intersections or other locations where traffic naturally slows, though CTR's observers have proven capable of making accurate seat belt use observations for moving traffic. In cases where preliminary site locations prove unusable, unsafe, or did not allow clear belt use observations, observers were able to choose alternate locations within the road segment where they can more effectively observe the same traffic stream.

2022 Survey Sample Update

Under NHTSA's current "Uniform Criteria for State Observational Surveys of Seat Belt Use," each state must re-sample roadway segments included in its statewide observational survey of seat belt use at least once every five years. Tennessee's current survey methodology was submitted to and approved by NHTSA in 2012. The first required update of observation sites was completed in 2017. Tennessee's second resampling effort was completed before the 2022 observational survey.

For the 2022 resampling effort, CTR partnered with Preusser Research Group (PRG) to conduct the required five-year update of the counties and observation sites included in the survey's sample. A review of updated Fatality Analysis Reporting System (FARS) data indicated that the 59-county sample population established in 2012 accounts for 85.2 percent of Tennessee's passenger-vehicle fatalities from 2015 through 2019. This meant that the observational survey could continue to use the original 16-county sample (established in 2012) until the next scheduled update in 2027. New observation sites were selected in each county using updated data from the Tennessee Department of Transportation's (TDOT's) Tennessee Roadway Information Management System (TRIMS) database.

The first version of the new roadway segment sample was submitted to NHTSA on December 14, 2021. CTR received word that NHTSA had approved the revised roadway segment sample on April 14, 2022. The approved roadway segment sample was used in the observational survey that began on April 21, 2022.

Seat Belt Use Observation Techniques

The Tennessee statewide observational survey of seat belt use incorporates several elements, including observer training procedures, general observation procedures, observation schedules, quality control monitoring, and data reviews, to promote the collection of consistent and accurate field data. These procedures also ensure that the Tennessee survey is fully compliant with all applicable survey regulations and guidelines.

Observation Team

Observers are hired and trained by CTR. All are trained to the specific requirements of Tennessee belt use observation. These observers perform all field data collection. Before any data collection, the grant director reviews all survey procedures with the observers in a training session which includes on-street practice.

Observers are also trained to deal with conditions (such as bad weather or temporary traffic impediments) that can require observation rescheduling and what to do to have sites rescheduled. They are also trained in how to obtain alternate sites should a primary site be completely unusable during the entire scheduled period. CTR typically utilizes between three and six observers, who will operate singly, and 1 or 2 quality control monitors will be utilized. Training will occur shortly before observations are scheduled to begin.

Observation Procedures

An observational segment is a homogeneous segment of roadway, generally ranging in length from 0.5 to 5 miles. A typical segment is approximately 1 mile in length. The longer segments tend to be on major roadways or in rural areas where there are few intersections and/or driveways. As noted above, specific observation sites (places along the segment from which the observer is to make belt use observations) are tentatively designated before any data collection. Observers may adjust the observation site to accommodate changing site conditions as long as the new location is still on the selected roadway segment.

An example of the observation site maps used by the data collection team is included in Appendix C. These maps indicate the roadway segment selected for observation (green line), the direction of travel selected for observation (indicated by the arrowhead on the green line), and the designated observation site (gold star).

Once at the designated observation location, the observer finds a safe spot to stand just beyond the edge of the roadway at or very near the intersection, if that is the selected location. The spot must be safe for the observer and traffic, e.g., not distracting to drivers, as well as affording a clear view of the belt use of occupants in approaching vehicles. From the selected vantage point, the observer records the belt use/nonuse of occupants of all passenger vehicles in the travel direction of record. If there are multiple approach lanes in the travel direction of record, the first preference is to record all vehicles in all approach lanes. If traffic is too heavy, then observers will identify a point down the road such that, when they complete recording data for the current vehicle, they can look up and select the next vehicle (in any approach lane) passing the point as the next one for observing.

The observer will record the belt use/nonuse of outboard front seat occupants, drivers and passengers, of qualifying vehicles in the travel direction of record. “Qualifying vehicles” include all passenger cars, pickup trucks, sport utility vehicles (SUVs), and vans, whether private or commercial, with a GVWR of 10,000 lbs. or less. Other vehicles, such as large buses, larger trucks, and farm equipment, are excluded from observation.

The shoulder belt use/nonuse of all outboard front seat occupants of qualifying vehicles is recorded. Proper placement of the shoulder belt is counted as restrained; nonuse or improper use (e.g., behind the back or under the arm) is counted as unrestrained. “Unknown” is coded if the observer cannot determine belt use. All outboard front seat passengers, regardless of age, are coded except infants in child safety seats; children in booster seats are coded. All qualified outboard front passengers receive code values, even if they are Unknown. A copy of the field observation form is included in Appendix C.

Site Scheduling

Observations are conducted on all days of the week during daylight hours between 7:00 a.m. and 6:00 p.m. Clusters of five or six sites are scheduled for one observer on any day. The sites in each county are divided into two or three clusters, with road function strata balanced between clusters, and those clusters are scheduled for different days of the week, not more than one weekend day per county. The assignment of days of the week is balanced across similar counties (e.g., urban/rural, part of the state) so that all days of the week have roughly similar numbers of clusters. Within these constraints, the actual day-of-week assignments are randomly determined.

The first site in any cluster to be observed each day will be randomly selected and the additional sites will be assigned in an order which provides balance by type of site and time of day while minimizing travel distance and

time. For each site, the schedule will specify the time of day, day of the week, the roadway to observe, and the direction of traffic to observe.

Depending on the number of sites in a cluster, the time from 7 a.m. to 6 p.m. are divided into nearly equal-length time periods. For five-site days, the time of day is specified as one of five time periods, such as 7:00 – 9:00 a.m., 9:00 – 11:00 a.m., 11:00 a.m. – 2:00 p.m., 2:00 – 4:00 p.m., and 4:00 – 6:00 p.m. For six-site days, time of day is specified as one of six time periods, such as 7:00 – 8:45 a.m., 8:45 – 10:30 a.m., 10:30 a.m. – 12:15 p.m., 12:15 – 2:30 p.m., 2:30 – 4:15 p.m., and 4:15 – 6:00 p.m.

The observation schedule for the current 190-site sample is included in Appendix C. This schedule identifies the site clusters within each county and assigns a specific time period to each site. Appendix C also includes a sample site description form which assigns site numbers, direction of travel for observation, and observation duration. The site description form also lists street names, route numbers, and segment lengths to supplement information on the individual observation segment maps.

In all cases, the period of actual seat belt use observation lasts exactly 45 minutes for Collectors and larger and 75 minutes for Local Roads and is required to take place within the broader allowable time period. Actual observation time periods will begin at the listed start times, or as close as practical to these times, i.e., as soon the observer can get positioned at the site after the beginning of the period. Observers are instructed to commence counting with the first vehicle which arrives at the site after the time period begins and to cease counting at the precise end of the 45-minute or 75-minute time period.

All data are collected within the reporting calendar year. Should additional data need to be collected, i.e., for sites with temporary obstacles such as bad weather, for sites that need to be replaced due to roadway or traffic disruptions, to replace invalid data, or to correct problems with total unknowns > 10 percent or a standard error > 2.5 percent, the additional data will be collected during the schedule period or as soon after that as practicable, but in all cases within the same calendar year.

The surveys continue during mild inclement weather, as long as observations can continue to be recorded with high accuracy and observer safety. In the event of more severe inclement weather, the surveys shall be discontinued until the weather eases. Then, the surveys are resumed according to the original schedule with the next time slot and the appropriate site. Missed observation periods will be rescheduled for the same time period and day of the week in a subsequent week.

If a site cannot be surveyed because of construction activities, safety concerns, or some other (semi-)permanent reason, the first preference is to find another suitable site along the same segment. If the entire segment is unusable, the location is abandoned. The observer is instructed to contact the overall project supervisor to be given an alternate site (same county, same road stratum) and direction for scheduling the observations. The alternate site will be scheduled for the same time of day and day of the week. As noted previously, alternate sites have been selected during the initial sampling process.

Quality Control Monitoring

Quality control monitors will conduct random, unannounced visits to at least 10 observation sites for quality control. The monitors ensure that the observer is in place and making observations during the observation period. Where possible, the monitor remains undetected by the observer. These unannounced checks ensure that all observers are adhering to established survey procedures and are reading observation site maps correctly.

Data Review

Data is reviewed as it is received, and anomalies are investigated to ensure that the data do not reflect anything other than proper on-site seat belt use observations. Some cues to the contrary include repeating patterns within the observation data, unusual proportions of vehicle type, driver or passenger sex, presence of passengers, seat belt use, excessive unknown seat belt use, or very high or low total numbers of observations. Some variation in these values is normal, of course. If suspicious data patterns are noted, the survey director will follow up to verify whether observations were done properly or not. Invalid data will be replaced, if possible, by conducting additional observations at the same site. If the site is unusable, then we will attempt to collect replacement data at another site on the same road segment, or if that is not possible, at a replacement site of the same road stratum in the same county. All additional or replacement data will be collected following the original time of day/day of week schedule.

The total percentage of "unknown" belt use observations typically can be kept at or below 1% through careful training and selection of observation sites. Similarly, the number of cases where the observer is unable to tell whether there is an outboard front passenger is estimated to be in the single digits for the entire survey data collection; this simply does not occur. Should overall "unknown" belt use observations exceed the 10% threshold, we will carefully review observer performance and the quality control results, to see if this signifies a larger problem such as falsifying data. Invalid data, if any, will be discarded. In any case, additional data will be collected until the appropriate "unknown" rate is within acceptable limits. We will begin by repeating data collection at the 20 percent of schedule clusters with the greatest percentage of unknowns, following the original schedule of time of day and day of the week. New data will be added to existing valid data.

Should any sites produce no usable data, our first preference will be to obtain usable data through follow-up observations, either at the original sites or different locations on the original segments or, if no sites on the original segments are usable, at substitute segments/sites, consistent with the original time of day/day of week schedule. Should that prove impossible, the sites will be dropped from the calculation formulas. Data imputation will not be used.

Seat Belt Usage Rate and Variability Calculations

Upon completion of field data collection, raw data are processed and evaluated by CTR to determine the state's overall average seat belt use rate. This process also calculates the standard error (as required by NHTSA's uniform survey criteria), relative error, and 95% confidence interval of the calculated average.

Calculation of Overall Seat Belt Usage Rate

Seat belt use rates are calculated using formulas based on the proportion of the state's total DVMT contributed by the site. Seat belt use rate calculations follow a four-step process.

1. Estimated rates are calculated for each of the five road type strata within each county.
2. A county-by-county seat belt use rate is obtained by combining county-stratum seat belt use rates across strata within counties, weighted by the class's relative contribution to total county DVMT.
3. Category-weighted seat belt use rates for each tier of counties are obtained by combining and weighting the rates from the sampled counties in each tier by their DVMT values and probabilities of being selected.
4. The statewide belt use proportion is calculated by combining the category proportions weighted by their proportion of statewide DVMT.

The result is a combination of the individual site seat belt use rates weighted to reflect each site's importance in total State DVMT. Estimates of subgroups of occupants, such as male drivers, female passengers, male drivers of pickup trucks, etc., are calculated in the same way.

Calculation of the Standard Error of the Overall Seat Belt Use Rate

Standard error of estimate values is estimated through a jackknife approach. The relative error rate and the 95% confidence interval are also calculated. These values are reported for the overall statewide seatbelt use rate. An Excel spreadsheet records raw data observations and calculates belt use and standard error. Calculation of seat belt usage rates follows the formulas described in Appendix D. For the statewide belt use figure to be reported to NHTSA, all observations are included, i.e., all vehicle types, drivers, and outboard front seat passengers. THSO is also interested in seat belt usage rates for subsets of interest, e.g., drivers alone, passengers alone, drivers and/or passengers within vehicle type, or males or females alone. The same calculations performed for the overall rate are performed for subsets of interest. SAS has been designated as Tennessee's alternate statistical analysis software in the unlikely event that Excel cannot be used to calculate the standard error of the state's safety belt usage rate.

Statistical Review

The review of the data collection efforts and results, noted above, continues with a statistical review of the results before any results are reported to NHTSA. The statistical review confirms that the results meet the criteria for the overall proportion of unknown belt use and standard error and ensure that proper adjustments were made in the case of data being completely absent for any site(s).

Rate of Unknown Belt Use Compliance

As noted above, the oversight of data collection includes monitoring the interim proportions of unknown belt use recorded. NHTSA's uniform survey criteria establish a maximum allowable nonresponse rate of 10 percent. Since 2012, the Tennessee observational survey has produced unknown belt usage rates ranging from a low of 0.000% in 2023 to a high of 1.398% in 2024. Should it be confirmed that proper observation procedures were used throughout, and the overall proportion of belt use unknowns still exceeds the 10 percent criterion, additional data collection would be ordered until the overall proportion dropped to or below 10 percent. We will begin by repeating data collection at the 20 percent of schedule clusters with the greatest percentage of unknowns, following the original schedule of time of day and day of the week. New data will be added to existing valid data.

Sites with No Valid Data

Every effort is made during the data collection phase to ensure that no site contributes no useful data. Steps would include rescheduling the original site, finding another site on the original road segment, and substituting a site on another segment in the same county-road stratum, with all data collected according to the original time of day/day of week schedule.

In the extremely unlikely case of a site still having no valid data, calculations will be adjusted accordingly. Data imputation will not be used. In the calculations for the affected county stratum, the (weighted) average will be based on the remaining site(s). Their weights will not require adjustment, because the relative importance of the remaining sites will be unchanged. Calculations of the other formulas will be unaffected. The same adjustment will be made in the jackknife standard error calculation.

Standard Error Compliance

Since 2012, the Tennessee observational survey has produced standard error rates ranging from a low of 0.464% in 2017 to a high of 0.663% in 2022. These standard error rates are far below NHTSA's maximum allowable error of 2.5 percent. However, if the data from a survey yield a standard error over the maximum allowable value, additional data would be collected until the criterion is satisfied. Additional data collection would begin with a preselected number of sites having the fewest observations, and new data would be added to existing valid data. If necessary, additional increments of data collection would be undertaken until the required reliability was met. In all cases, additional data for sites would be following the same time of day/day of the week requirements as in the original schedule.

2024 Observational Survey Results

CTR conducted the 2024 statewide observational survey of seat belt use in March, April, and May. Field data collection began on Monday, March 4, and concluded on Friday, May 17. During this period the survey team consisted of two observers and one quality control monitor (the survey director). Observers recorded belt use/non-use information for 28,837 occupants in 24,458 passenger vehicles. Observers were unable to determine the belt use of 403 occupants (1.398%).

23 CFR Part 1340 Reporting Elements

The data gathered in this period returned an average statewide seat belt usage rate of 92.2% (+/- 1.2%). Tennessee's 2024 average seat belt usage rate is 0.2% higher than the 2023 rate (92.0%) and is Tennessee's highest recorded rate. The standard error rate was calculated to be 0.603% and the nonresponse (unknown belt usage rate) was 1.398%. Both values are below their maximum allowable levels of 2.5% and 10%, respectively. A summary of the 2024 survey results is shown in Table 2.

Table 2: Summary of 2024 Tennessee Seat Belt Use

County	No. of Sites	Adjusted Usage Rates					
		Passenger Cars	Vans	SUVs	Cars + Vans + SUVs	Pickup Trucks	All Vehicles
Davidson	15	94.3%	85.9%	96.9%	93.7%	88.2%	92.5%
Hamilton	15	95.0%	91.4%	94.4%	93.6%	90.1%	92.8%
Knox	15	97.3%	90.5%	96.2%	96.6%	88.8%	94.7%
Shelby	15	92.5%	91.3%	95.7%	93.3%	84.0%	91.7%
Blount	11	92.8%	78.7%	97.0%	93.8%	77.4%	90.4%
Dyer	11	98.4%	100.0%	89.0%	96.7%	85.8%	93.8%
Loudon	11	96.9%	81.1%	93.3%	93.7%	80.1%	89.8%
McMinn	11	97.8%	99.7%	99.6%	98.4%	94.1%	97.0%
Marion	11	96.8%	82.7%	97.5%	94.9%	85.5%	92.0%
Montgomery	11	96.9%	93.5%	97.1%	96.5%	83.7%	93.7%
Roane	11	97.3%	100.0%	100.0%	98.0%	82.2%	92.0%
Rutherford	11	95.3%	87.2%	95.8%	94.4%	79.9%	91.0%
Sevier	11	95.1%	82.7%	97.4%	94.9%	80.0%	90.1%
Tipton	10	94.2%	98.5%	96.1%	95.0%	82.8%	91.0%
Warren	10	93.4%	88.8%	97.6%	94.0%	76.4%	86.8%
Williamson	11	95.4%	90.1%	97.5%	95.9%	86.7%	94.0%
Statewide Totals	**190**	**95.3%**	**89.9%**	**96.3%**	**95.0%**	**84.6%**	**92.2%**

Additional Observational Survey Results

Within the 2024 results, increased belt use was observed in three of the four vehicle categories. The largest year-to-year increases were observed among Pickup Truck occupants (+2.2%), followed by occupants in Passenger Cars (+0.2%) and Sport Utility Vehicles (+0.2%). Belt use among front seat occupants in Vans was down (-1.7%). Sport Utility Vehicle occupants continue to lead among all vehicle types with an average belt use of 96.3%. While belt use among Pickup Truck occupants increased in 2024, their rate still lags far behind those in other vehicle types. In 2024, none of the 16 survey counties had a belt use rate of less than 85%. Conversely, 14 of the 16 counties had belt use rates exceeding 90%. The lowest seat belt use rate was recorded in Warren County (86.8%), while the highest use rate was recorded in McMinn County (97.0%). Additional details of the 2024 observational survey, including observation results for individual sites, can be found in the 2024 State Seat Belt Use Survey Reporting Form, included in this report as Appendix A.

In addition to the primary measures of belt usage by vehicle type, the survey also allows CTR to determine the belt usage for more specific occupant groups, including categories for gender and occupant type/position. The survey also provides estimated usage rates for specific combinations of categories, such as the 69.8% average usage rate among male pickup truck passengers in non-certainty counties. The calculation spreadsheets also allow for a comparison of rates between the certainty counties (Davidson, Hamilton, Knox, and Shelby) and the 12 randomly selected, or non-certainty, counties.

These specific observed rates can be used to verify assumed usage trends among specific groups of interest or to adjust enforcement and education strategies where these assumptions are shown to be incorrect. These

assumptions are generally confirmed by the results. By gender, 89.2% of observed male occupants were belted versus 96.2% of female occupants. This year, drivers were belted at a rate of 92.1% and passengers were belted at a rate of 92.3%. A summary of survey observations for occupants with known belt use shows results by vehicle type and occupant type in Table 3.

Table 3: Summary of Observations and Belt Usage by Vehicle and Occupant Types

	Drivers		Passengers		All Occupants		
Vehicle Type	**No. Observed**	**Rate**	**No. Observed**	**Rate**	**No. Observed**	**Rate**	**% All Occs.**
Passenger Cars	8,767	95.0%	1,380	96.1%	10,147	95.3%	35.7%
Sport Utility Vehicles	7,986	96.1%	1,521	97.3%	9,507	96.3%	33.4%
Vans	1,776	89.4%	429	94.4%	2,205	89.9%	7.8%
Pickup Trucks	5,531	84.8%	1,041	82.5%	6,572	84.6%	23.1%
All Vehicles	24,060	92.1%	4,371	92.3%	28,431	92.2%	100.0%

Vehicle occupants in the certainty counties (92.7%) were more likely to be belted than occupants in smaller, randomly selected counties (91.8%). Looking at all possible combinations, the highest observed belt use rate was for female SUV passengers in non-certainty counties (99.1%). The lowest belt usage rate was observed among male pickup truck passengers in non-certainty counties (69.8%). The complete results of this multi-category analysis may be found in Appendix B (Jackknife Variance Calculation for All Vehicles/All Occupants).

Finally, the survey allows CTR to estimate seat belt usage by roadway functional classification (as defined in the previous "Road Segment Allocation" section. These estimates generally confirm the widely held belief that average seat belt use increases as travel speeds and traffic volumes increase. The highest observed usage rates were for passenger vehicle occupants traveling on Interstates and Other Expressways (94.5%). Conversely, the lowest observed usage rate was for occupants traveling on Local Roads (87.6%). Estimated belt use rates for all roadway functional classifications are shown in Table 4.

Table 4: Estimated 2024 Belt Use by Roadway Functional Classification

Roadway Functional Classification	Estimated 2022 Seat Belt Usage Rate
Interstates and Other Expressways	94.5%
Other Principal Arterials	94.0%
Minor Arterials	93.4%
Collectors	89.5%
Local Roads	87.6%

Historical, Regional, and National Perspective for 2024 Survey Results

To further illustrate the recent trends in seat belt usage across the state of Tennessee, Table 5 and Figure 2 show annual usage rates for all vehicles, passenger cars, pickup trucks, vans, and sport utility vehicles since 2000.

Table 5: Summary of Tennessee Seat Belt Usage, 2000-2024

Survey Year	Passenger Cars	Pickup Trucks	Vans	Sport Utility Vehicles	All Vehicles
2000	64.2%	39.3%	68.5%	73.0%	59.0%
2001	73.5%	53.9%	70.4%	75.9%	68.3%
2002	71.0%	53.0%	71.8%	73.6%	66.7%
2003	72.5%	55.0%	71.3%	75.4%	68.4%
2004	76.1%	57.5%	75.7%	77.3%	72.0%
2005	78.2%	62.6%	77.3%	79.5%	74.4%
2006	82.1%	69.4%	80.0%	82.0%	78.6%
2007	83.3%	72.3%	80.8%	82.7%	80.2%
2008	84.5%	75.1%	83.9%	78.3%	81.5%
2009	81.8%	73.5%	82.8%	84.7%	80.6%
2010	89.0%	81.8%	82.8%	88.6%	87.1%
2011	90.1%	77.9%	88.9%	88.4%	87.4%
2012	85.1%	75.5%	87.1%	88.8%	83.7%
2013	86.8%	75.9%	89.5%	88.2%	84.8%
2014	90.3%	79.1%	91.2%	90.3%	87.7%
2015	87.8%	78.3%	86.4%	90.6%	86.2%
2016	91.4%	81.8%	90.4%	92.5%	89.0%
2017	91.2%	81.3%	89.4%	91.0%	88.5%
018	93.5%	84.2%	93.5%	93.4%	90.9%
2019	94.7%	84.9%	89.3%	95.5%	91.8%
2020	94.7%	84.9%	89.3%	95.5%	91.8%
2021	92.5%	83.8%	90.6%	94.3%	90.1%
2022	93.1%	80.6%	89.7%	96.0%	90.5%
2023	95.1%	82.4%	91.6%	96.1%	92.0%
2024	95.3%	84.6%	89.9%	96.3%	92.2%

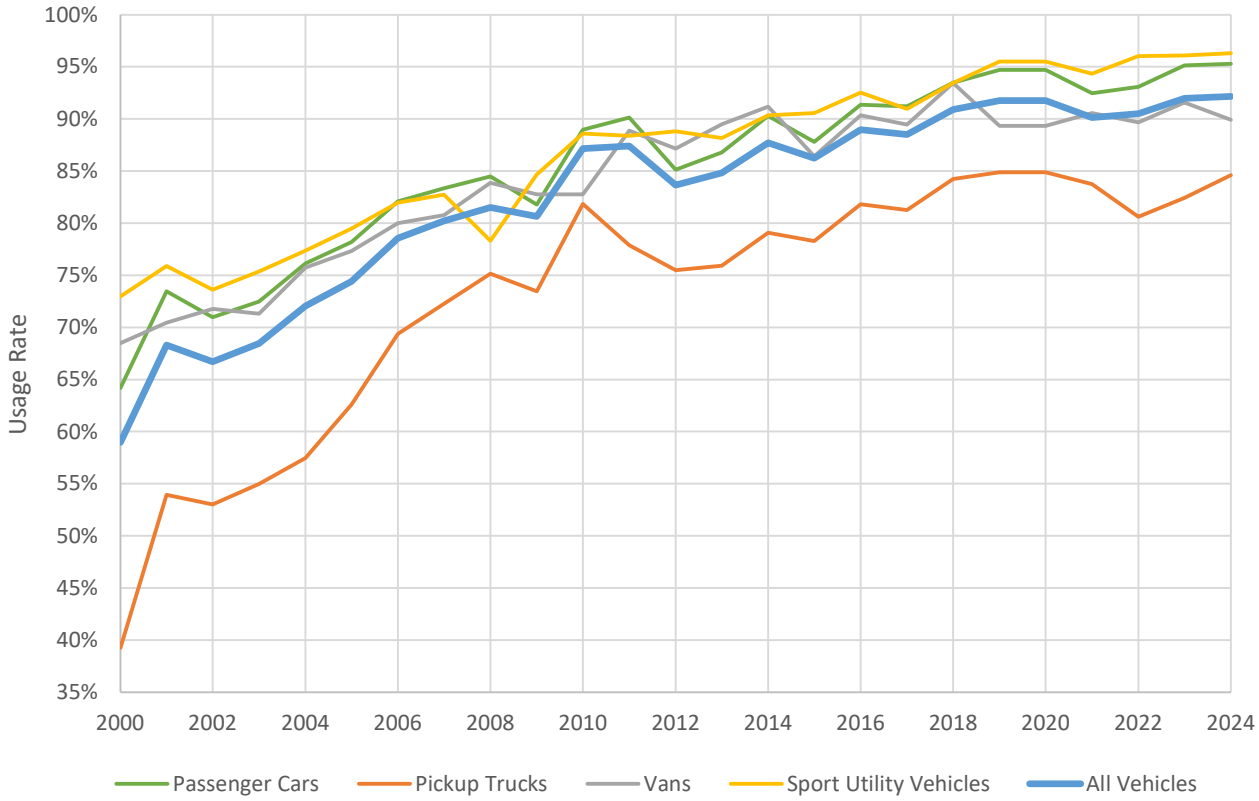


Figure 1: Tennessee Average Safety Belt Use, 2000-2024

While Tennessee's average seat belt usage rate has climbed considerably in the last 20 years, the state's rate is still middle-of-the-pack when compared to those of its peers in NHTSA Region 4. Tennessee's reported belt use rate has ranked third among the five states in each of the last five years in which an observational survey was completed. In 2023, the most recent year in which average belt use rates are available for all states, Tennessee's average use rate of 92.0% trails rates reported by South Carolina (93.2%) and Alabama (93.4%). A comparison of 2018-2023 average seat belt use among states in NHTSA Region 4 is shown below in Table 6.

Table 6: Belt Use by State in NHTSA Region 4, 2018-2023[4]

State	2018		2019		2021		2022		2023		Average Rank, 2018-2023
	Belt Use	Regional Rank	Belt Use	Regional Rank	Belt Use	Regional Rank	Belt Use	Regional Rank	Belt Use	Regional Rank	
Alabama	91.8%	2	92.3%	2	91.3%	2	92.7%	1	93.4%	1	1.6
Florida	90.6%	4	89.8%	5	90.1%	3	88.3%	5	89.4%	4	4.2
Georgia	96.3%	1	95.9%	1	94.8%	1	89.3%	4	87.6%	5	2.4
South Carolina	89.7%	5	90.3%	4	90.1%	3	90.6%	2	93.2%	2	3.2
Tennessee	90.9%	3	91.8%	3	90.1%	3	90.5%	3	92.0%	3	3

Tennessee's 2019 average seat belt usage rate (91.8%) exceeded the nationwide average usage rate of 90.7%. Only 19 states and two US territories conducted observational surveys of belt use in 2020, but NHTSA did complete its annual National Occupant Protection Use Survey (NOPUS). The 2020 NOPUS reported that national seat belt use dropped slightly to 90.3%. In 2021, Tennessee's average seat belt use rate (90.1%) fell slightly below the NOPUS rate of 90.4%. In 2022, the gap between Tennessee and national belt use grew (90.5% versus 91.6%). Last year, Tennessee's 2023 average belt use rate of 92.0% put the state slightly ahead of the national rate (91.9%). Figure 3 shows Tennessee's performance versus the national average since 2000.

[4] National Center for Statistics and Analysis. (2024, August). *Seat belt use in 2023— Use rates in the States and Territories* (Traffic Safety Facts Crash•Stats. Report No. DOT HS 813 615). National Highway Traffic Safety Administration.

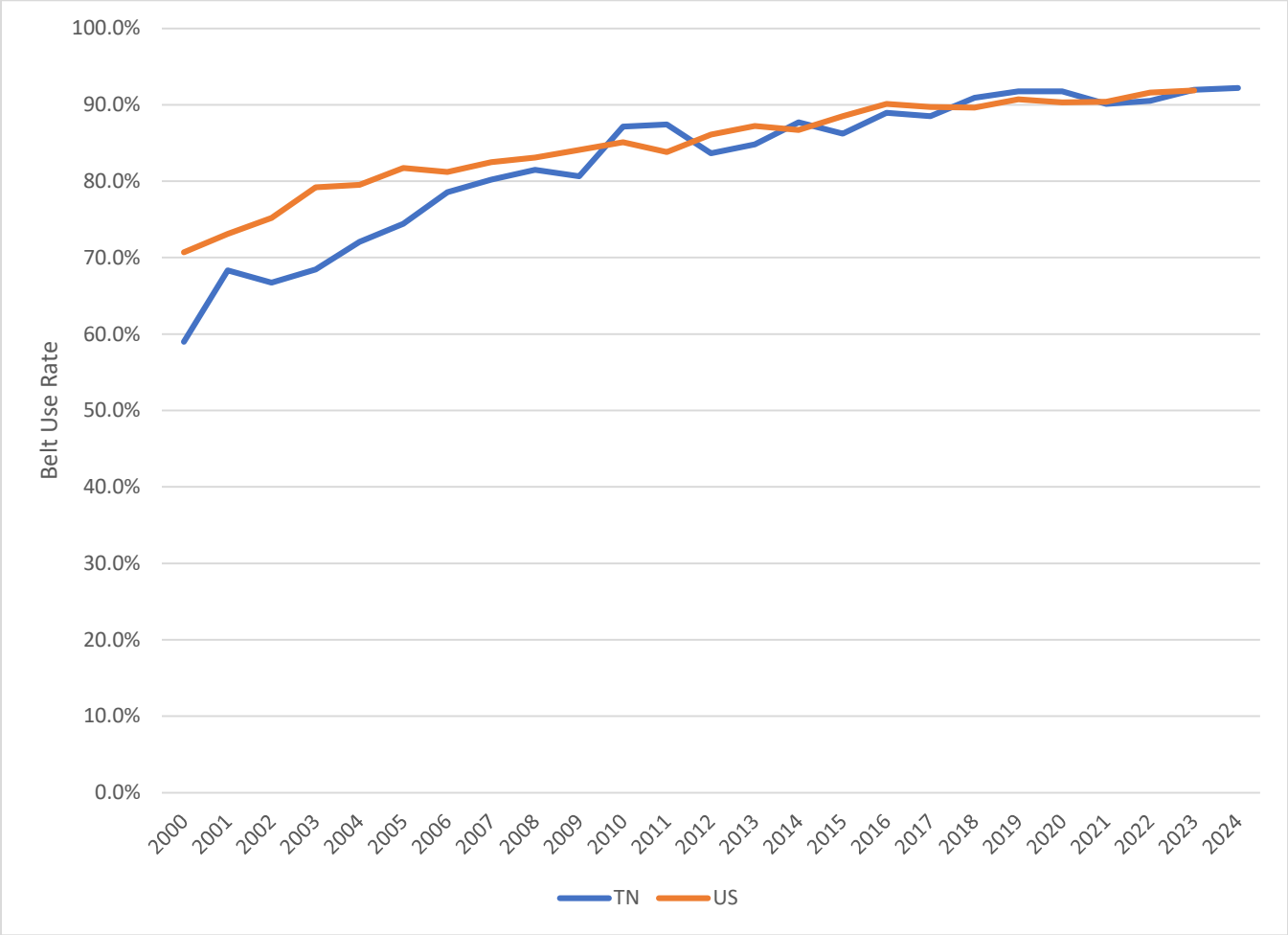


Figure 2: 2000 - 2024 Belt Use, Tennessee vs. National Average

Appendix A: Tennessee 2024 State Seat Belt Use Survey Reporting Form

Tennessee Seat Belt Use Survey Reporting Form

Part A:*

State: TENNESSEE

Calendar Year of Survey: 2024

Statewide Seat Belt Use Rate: 92.17%

I hereby certify that:

Jeff Long, Commissioner of the Tennessee Department of Safety and Homeland Security, has been designated by the Governor as the State's Highway Safety Representative (GR), and if applicable, the GR has delegated the authority to sign the certification in writing to Clyde Lewis, Director, the Coordinator of the State Highway Safety Office.

The reported Statewide seat belt use rate is based on a survey design that was approved by NHTSA, in writing, as conforming to the Uniform Criteria for State Observational Surveys of Seat Belt Use, 23 CFR Part 1340.

The survey design has remained unchanged since the survey was approved by NHTSA.

Neil K. Chaudhary, Ph.D., a qualified survey statistician, has reviewed the seat belt use rate reported above and information reported in Part B and has determined that they meet the Uniform Criteria for State Observational Surveys of Seat Belt Use, 23 CFR Part 1340.

Signature: _____

Date: _____

Printed Name: _____

** To be completed by the GR or, if applicable, the Coordinator of the State Highway Safety Office.*

Part B:

Statewide standard error: 0.603%

Nonresponse rate: 1.398%

	Statewide	Numbers of Occupants …			Percent
	Total	Belted	Unbelted	Unkn Use	Unkn Use
Drivers:	22,396	1,664	392	1.603%	
Passengers:	4,092	279	11	0.251%	
Total:	26,488	1,943	403	1.398%	

Site ID	Orig/ Alt-Repl	Date Observed	Selection Prob.	Formula 1 Weight	Total Number of …		Numbers of Occupants …		
					Drivers	Qual Psgrs	Belted	Unbelted	Unkn Use
5101	1-Orig	4/19/2024	0.57482	1.740	278	25	274	27	2
5102	1-Orig	4/19/2024	0.83633	1.196	171	38	176	17	16
5201	1-Orig	4/19/2024	0.13895	7.197	425	92	484	18	15
5202	1-Orig	4/18/2024	0.05382	18.582	473	101	535	37	2
5301	1-Orig	4/18/2024	0.04965	20.140	216	20	211	17	8
5302	1-Orig	4/18/2024	0.01077	92.848	260	24	252	24	8
5401	1-Orig	4/18/2024	0.05951	16.805	181	41	206	13	3
5402	1-Orig	4/18/2024	0.03033	32.972	91	16	89	14	4
5501	1-Orig	4/19/2024	0.00054	1,838.509	6	0	5	1	0
5502	1-Orig	4/18/2024	0.01270	78.713	35	10	34	11	0
5503	1-Orig	4/19/2024	0.00167	599.657	42	4	38	6	2
19101	1-Orig	5/8/2024	0.04506	22.192	180	34	204	10	0
19102	1-Orig	5/9/2024	0.02626	38.083	244	26	257	13	0
19103	1-Orig	5/10/2024	0.03052	32.769	51	10	53	7	1
19201	1-Orig	5/10/2024	0.03433	29.133	199	24	206	17	0
19202	1-Orig	5/9/2024	0.01618	61.817	225	55	270	10	0
19203	1-Orig	5/8/2024	0.02484	40.261	166	36	190	12	0
19301	1-Orig	5/10/2024	0.01775	56.353	116	20	123	13	0
19302	1-Orig	5/8/2024	0.03827	26.128	96	18	106	8	0
19303	1-Orig	5/9/2024	0.03026	33.042	138	28	153	12	1
19401	1-Orig	5/9/2024	0.00355	281.768	82	11	83	10	0
19402	1-Orig	5/9/2024	0.00853	117.237	161	29	185	5	0
19403	1-Orig	5/8/2024	0.01108	90.293	99	20	109	10	0
19501	1-Orig	5/10/2024	0.00216	462.425	21	6	25	2	0
19502	1-Orig	5/10/2024	0.00150	667.196	57	5	52	10	0
19503	1-Orig	5/8/2024	0.00109	921.555	41	8	45	4	0
23101	1-Orig	4/22/2024	0.47354	2.112	24	3	25	2	0
23102	1-Orig	4/21/2024	0.13949	7.169	18	5	22	1	0
23201	1-Orig	4/21/2024	0.07074	14.136	129	51	174	6	0
23202	1-Orig	4/21/2024	0.18369	5.444	12	5	17	0	0
23301	1-Orig	4/22/2024	0.27200	3.677	78	29	104	3	0
23302	1-Orig	4/21/2024	0.08718	11.470	80	30	106	4	0
23401	1-Orig	4/22/2024	0.02628	38.052	10	3	11	2	0
23402	1-Orig	4/21/2024	0.03803	26.293	54	14	64	4	0
23504	2-Spare	4/22/2024	0.00596	167.806	13	1	11	3	0
23502	1-Orig	4/22/2024	0.00588	170.031	9	0	9	0	0
23503	1-Orig	4/21/2024	0.01493	66.959	30	4	30	4	0
33101	1-Orig	3/5/2024	0.06732	14.854	17	5	21	1	0
33102	1-Orig	3/5/2024	0.15539	6.435	55	5	53	6	1
33104	2-Spare	3/6/2024	0.08958	11.163	45	8	50	3	0
33201	1-Orig	3/6/2024	0.03115	32.103	202	38	215	25	0
33202	1-Orig	3/5/2024	0.07122	14.042	152	12	155	8	1

33203	1-Orig	3/4/2024	0.15462	6.467	83	18	97	3	1
33301	1-Orig	3/6/2024	0.00564	177.260	77	13	79	11	0
33302	1-Orig	3/5/2024	0.02566	38.969	93	8	94	7	0
33303	1-Orig	3/4/2024	0.01480	67.569	76	13	84	5	0
33401	1-Orig	3/4/2024	0.03759	26.603	31	4	33	2	0
33402	1-Orig	3/4/2024	0.02092	47.800	14	1	11	4	0
33403	1-Orig	3/4/2024	0.01219	82.056	26	3	26	1	2
33501	1-Orig	3/5/2024	0.00030	3,360.139	17	3	19	1	0
33502	1-Orig	3/6/2024	0.00078	1,284.759	15	2	17	0	0
33503	1-Orig	3/6/2024	0.00024	4,104.331	7	1	7	1	0
47101	1-Orig	3/13/2024	0.03979	25.135	220	47	259	8	0
47102	1-Orig	3/11/2024	0.00680	146.994	19	5	24	0	0
47103	1-Orig	3/11/2024	0.06338	15.779	173	47	215	4	1
47201	1-Orig	3/13/2024	0.00939	106.544	321	50	358	11	2
47204	2-Spare	3/11/2024	0.07357	13.593	222	58	267	12	1
47203	1-Orig	3/11/2024	0.16849	5.935	202	47	238	11	0
47301	1-Orig	3/13/2024	0.03989	25.066	184	44	220	7	1
47302	1-Orig	3/12/2024	0.00129	776.146	135	26	149	11	1
47303	1-Orig	3/12/2024	0.05519	18.118	167	23	178	12	0
47401	1-Orig	3/12/2024	0.01369	73.038	137	31	164	4	0
47402	1-Orig	3/11/2024	0.01056	94.685	25	3	26	2	0
47403	1-Orig	3/13/2024	0.00604	165.598	64	5	63	6	0
47501	1-Orig	3/12/2024	0.00276	362.706	57	4	57	4	0
47502	1-Orig	3/13/2024	0.00033	3,004.484	16	6	21	1	0
47503	1-Orig	3/12/2024	0.00248	402.965	29	7	27	9	0
53101	1-Orig	4/26/2024	0.12556	7.964	125	28	138	14	1
53102	1-Orig	4/26/2024	0.10204	9.800	106	28	119	12	3
53201	1-Orig	4/25/2024	0.11953	8.366	113	12	107	14	4
53202	1-Orig	4/25/2024	0.10575	9.456	487	66	515	33	5
53301	1-Orig	4/26/2024	0.10714	9.334	172	18	163	20	7
53302	1-Orig	4/26/2024	0.04436	22.541	362	86	422	21	5
53401	1-Orig	4/23/2024	0.02578	38.790	53	8	48	12	1
53402	1-Orig	4/23/2024	0.03295	30.346	51	8	49	9	1
53501	1-Orig	4/26/2024	0.00520	192.220	26	0	24	1	1
53502	1-Orig	4/26/2024	0.00741	134.911	23	5	21	6	1
53505	2-Spare	4/25/2024	0.00400	249.938	19	10	25	4	0
54101	1-Orig	3/25/2024	0.09164	10.912	127	54	180	1	0
54102	1-Orig	3/25/2024	0.47411	2.109	12	1	13	0	0
54201	1-Orig	3/25/2024	0.01942	51.501	97	26	117	6	0
54202	1-Orig	3/26/2024	0.03854	25.950	84	6	86	3	1
54301	1-Orig	3/26/2024	0.05661	17.666	27	2	26	3	0
54302	1-Orig	3/25/2024	0.06313	15.841	89	23	104	7	1
54401	1-Orig	3/25/2024	0.10412	9.604	36	10	41	4	1
54402	1-Orig	3/26/2024	0.02763	36.189	15	1	15	1	0
54501	1-Orig	3/26/2024	0.00737	135.594	30	6	36	0	0
54502	1-Orig	3/26/2024	0.00457	218.609	7	3	10	0	0
54503	1-Orig	3/25/2024	0.01892	52.866	35	4	35	4	0
58101	1-Orig	5/13/2024	0.20291	4.928	40	8	42	0	6
58102	1-Orig	5/13/2024	0.39476	2.533	81	13	82	9	3
58201	1-Orig	5/12/2024	0.13614	7.346	248	92	303	24	13
58202	1-Orig	5/13/2024	0.21495	4.652	363	73	392	29	15
58301	1-Orig	5/12/2024	0.58276	1.716	147	51	173	24	1
58302	1-Orig	5/13/2024	0.02444	40.922	117	23	131	9	0
58401	1-Orig	5/13/2024	0.02517	39.723	68	10	61	14	3
58402	1-Orig	5/12/2024	0.02720	36.769	7	1	7	0	1
58501	1-Orig	5/12/2024	0.01482	67.464	7	1	5	3	0
58504	2-Spare	5/13/2024	0.00458	218.331	12	3	10	5	0
58503	1-Orig	5/12/2024	0.00668	149.783	25	10	28	6	1
63101	1-Orig	5/6/2024	0.09686	10.324	161	24	172	13	0
63102	1-Orig	5/6/2024	0.13135	7.613	48	3	50	1	0
63201	1-Orig	5/7/2024	0.13604	7.351	295	60	335	17	3
63202	1-Orig	5/7/2024	0.02112	47.350	206	29	229	6	0
63301	1-Orig	5/7/2024	0.06194	16.145	266	42	291	17	0
63302	1-Orig	5/7/2024	0.01574	63.533	115	24	129	10	0
63401	1-Orig	5/6/2024	0.01633	61.238	15	1	16	0	0
63402	1-Orig	5/7/2024	0.14314	6.986	65	6	67	4	0
63501	1-Orig	5/7/2024	0.00104	962.135	39	6	38	7	0
63504	2-Spare	5/6/2024	0.00229	435.839	8	1	7	2	0
63503	1-Orig	5/6/2024	0.00883	113.234	45	12	55	2	0
73101	1-Orig	3/19/2024	0.26146	3.825	33	8	35	6	0
73102	1-Orig	3/19/2024	0.10426	9.591	18	3	21	0	0
73201	1-Orig	3/18/2024	0.07994	12.509	80	17	87	10	0
73202	1-Orig	3/19/2024	0.18952	5.276	128	19	141	6	0
73301	1-Orig	3/18/2024	0.07371	13.567	87	12	95	3	1
73302	1-Orig	3/18/2024	0.14945	6.691	38	10	42	6	0
73401	1-Orig	3/18/2024	0.01823	54.848	16	0	12	4	0
73402	1-Orig	3/18/2024	0.03018	33.137	33	7	39	1	0
73501	1-Orig	3/18/2024	0.00119	837.837	17	0	17	0	0
73502	1-Orig	3/19/2024	0.02410	41.486	6	0	5	1	0
73503	1-Orig	3/19/2024	0.00567	176.222	74	7	77	4	0
75101	1-Orig	5/2/2024	0.04628	21.609	247	37	260	20	4
75102	1-Orig	5/1/2024	0.23705	4.219	348	38	351	28	7

75201	1-Orig	5/1/2024	0.04896	20.424	333	47	351	24	5
75202	1-Orig	5/2/2024	0.03653	27.375	362	43	358	41	6
75301	1-Orig	5/1/2024	0.03322	30.105	475	36	458	45	8
75302	1-Orig	5/1/2024	0.01649	60.642	369	53	392	29	1
75401	1-Orig	5/2/2024	0.01640	60.987	136	12	132	14	2
75402	1-Orig	5/1/2024	0.08587	11.645	65	4	62	4	3
75501	1-Orig	5/2/2024	0.00069	1,457.428	61	9	62	7	1
75502	1-Orig	5/1/2024	0.00096	1,043.995	25	7	27	5	0
75503	1-Orig	5/2/2024	0.00301	332.396	51	4	45	9	1
78101	1-Orig	5/17/2024	0.28018	3.569	359	119	453	16	9
78102	1-Orig	5/17/2024	0.68094	1.469	333	127	430	20	10
78201	1-Orig	5/17/2024	0.13241	7.552	350	124	438	34	2
78202	1-Orig	5/17/2024	0.12267	8.152	422	139	513	36	12
78301	1-Orig	5/16/2024	0.03802	26.300	520	148	617	35	16
78302	1-Orig	5/17/2024	0.18818	5.314	246	57	277	14	12
78401	1-Orig	5/16/2024	0.02162	46.254	321	48	330	31	8
78402	1-Orig	5/16/2024	0.01559	64.160	162	49	186	17	8
78501	1-Orig	5/17/2024	0.00083	1,199.798	9	2	6	5	0
78502	1-Orig	5/16/2024	0.00178	561.951	42	31	67	6	0
78503	1-Orig	5/16/2024	0.00128	781.891	22	1	22	1	0
79101	1-Orig	4/24/2024	0.03651	27.388	135	15	139	10	1
79102	1-Orig	4/24/2024	0.00721	138.664	107	9	107	9	0
79103	1-Orig	4/24/2024	0.06064	16.491	259	15	264	8	2
79201	1-Orig	4/23/2024	0.02817	35.498	251	27	249	19	10
79202	1-Orig	4/23/2024	0.02228	44.886	125	22	139	7	1
79203	1-Orig	4/25/2024	0.05741	17.418	184	17	187	14	0
79301	1-Orig	4/24/2024	0.00339	294.567	93	15	95	12	1
79302	1-Orig	4/25/2024	0.01318	75.846	121	14	132	2	1
79303	1-Orig	4/25/2024	0.03842	26.027	204	39	229	11	3
79401	1-Orig	4/25/2024	0.00422	236.923	40	2	39	3	0
79402	1-Orig	4/25/2024	0.02143	46.663	101	22	114	9	0
79403	1-Orig	4/23/2024	0.01796	55.687	29	7	19	17	0
79504	2-Spare	4/23/2024	0.00020	4,982.989	4	0	3	1	0
79502	1-Orig	4/24/2024	0.00018	5,694.845	29	2	30	1	0
79503	1-Orig	4/23/2024	0.00019	5,276.106	54	7	52	9	0
84201	1-Orig	4/19/2024	0.13129	7.617	73	7	72	7	1
84202	1-Orig	4/20/2024	0.06898	14.497	158	37	179	12	4
84203	1-Orig	4/20/2024	0.09746	10.261	163	38	188	13	0
84301	1-Orig	4/19/2024	0.07842	12.752	48	13	58	3	0
84302	1-Orig	4/20/2024	0.05799	17.245	89	28	103	13	1
84401	1-Orig	4/19/2024	0.02620	38.168	39	4	39	4	0
84402	1-Orig	4/20/2024	0.00958	104.339	14	2	14	1	1
84501	1-Orig	4/19/2024	0.00250	399.861	18	4	21	1	0
84502	1-Orig	4/19/2024	0.01441	69.381	16	2	14	4	0
84503	1-Orig	4/20/2024	0.00242	412.995	117	26	120	21	2
89101	1-Orig	5/10/2024	0.52562	1.903	337	53	346	23	21
89201	1-Orig	5/9/2024	0.08906	11.228	291	70	326	23	12
89202	1-Orig	5/9/2024	0.04226	23.663	31	6	30	4	3
89301	1-Orig	5/7/2024	0.19363	5.165	132	26	140	13	5
89302	1-Orig	5/10/2024	0.02217	45.102	214	26	206	24	10
89401	1-Orig	5/9/2024	0.07003	14.279	57	12	48	13	8
89402	1-Orig	5/9/2024	0.01647	60.726	90	26	91	23	2
89505	2-Spare	5/2/2024	0.00690	144.901	28	7	32	3	0
89502	1-Orig	5/10/2024	0.00308	324.251	42	3	39	4	2
89503	1-Orig	5/10/2024	0.00229	437.316	10	1	6	5	0
94101	1-Orig	4/30/2024	0.19831	5.043	294	26	304	14	2
94103	2-Spare	4/29/2024	0.11648	8.586	527	82	581	23	5
94201	1-Orig	4/29/2024	0.02092	47.795	445	53	450	44	4
94202	1-Orig	4/30/2024	0.03733	26.786	435	36	431	31	9
94301	1-Orig	4/30/2024	0.09063	11.034	520	15	487	31	17
94302	1-Orig	4/30/2024	0.05656	17.681	277	28	290	15	0
94401	1-Orig	4/29/2024	0.01693	59.052	88	8	85	11	0
94402	1-Orig	4/29/2024	0.02522	39.658	378	18	366	23	7
94501	1-Orig	4/29/2024	0.00121	824.460	53	8	59	2	0
94502	1-Orig	4/30/2024	0.00227	440.785	49	4	50	3	0
94503	1-Orig	4/30/2024	0.00052	1,930.788	29	1	25	4	1
TOTAL					**24,452**	**4,382**	**26,488**	**1,943**	**403**

Tennessee Seat Belt Use Survey Reporting Form

Class-County	County-Class		FHWA DVMT
51	Blount-FwyXwy	FwyXwy	119,124
52	Blount-PrinArt	PrinArt	1,230,345
53	Blount-MinArt	MinArt	556,295
54	Blount-Collector	Collector	541,849
55	Blount-LocalRd	LocalRd	746,551
191	Davidson-FwyXwy	FwyXwy	11,645,079
192	Davidson-PrinArt	PrinArt	4,569,519
193	Davidson-MinArt	MinArt	1,969,597
194	Davidson-Collector	Collector	1,889,467
195	Davidson-LocalRd	LocalRd	4,320,725
231	Dyer-FwyXwy	FwyXwy	242,816
232	Dyer-PrinArt	PrinArt	444,620
233	Dyer-MinArt	MinArt	121,990
234	Dyer-Collector	Collector	288,558
235	Dyer-LocalRd	LocalRd	230,391
331	Hamilton-FwyXwy	FwyXwy	3,659,575
332	Hamilton-PrinArt	PrinArt	1,930,328
333	Hamilton-MinArt	MinArt	1,985,860
334	Hamilton-Collector	Collector	660,406
335	Hamilton-LocalRd	LocalRd	1,484,350
471	Knox-FwyXwy	FwyXwy	5,884,974
472	Knox-PrinArt	PrinArt	2,456,540
473	Knox-MinArt	MinArt	2,456,046
474	Knox-Collector	Collector	1,642,401
475	Knox-LocalRd	LocalRd	3,449,335
531	Loudon-FwyXwy	FwyXwy	1,155,685
532	Loudon-PrinArt	PrinArt	400,960
533	Loudon-MinArt	MinArt	288,918
534	Loudon-Collector	Collector	229,641
535	Loudon-LocalRd	LocalRd	240,466
541	McMinn-FwyXwy	FwyXwy	1,074,536
542	McMinn-PrinArt	PrinArt	531,647
543	McMinn-MinArt	MinArt	167,195
544	McMinn-Collector	Collector	278,171
545	McMinn-LocalRd	LocalRd	259,616
581	Marion-FwyXwy	FwyXwy	1,292,780
582	Marion-PrinArt	PrinArt	214,304
583	Marion-MinArt	MinArt	102,946
584	Marion-Collector	Collector	254,596
585	Marion-LocalRd	LocalRd	173,687
631	Montgomery-FwyXwy	FwyXwy	982,887
632	Montgomery-PrinArt	PrinArt	1,044,459
633	Montgomery-MinArt	MinArt	1,247,831
634	Montgomery-Collector	Collector	503,984
635	Montgomery-LocalRd	LocalRd	832,929
731	Roane-FwyXwy	FwyXwy	873,141
732	Roane-PrinArt	PrinArt	446,043
733	Roane-MinArt	MinArt	287,176
734	Roane-Collector	Collector	208,511
735	Roane-LocalRd	LocalRd	175,876
751	Rutherford-FwyXwy	FwyXwy	3,368,306
752	Rutherford-PrinArt	PrinArt	1,434,027
753	Rutherford-MinArt	MinArt	1,838,375
754	Rutherford-Collector	Collector	891,621
755	Rutherford-LocalRd	LocalRd	1,996,227
781	Sevier-FwyXwy	FwyXwy	306,884
782	Sevier-PrinArt	PrinArt	1,405,787
783	Sevier-MinArt	MinArt	725,753
784	Sevier-Collector	Collector	593,091
785	Sevier-LocalRd	LocalRd	1,097,474
791	Shelby-FwyXwy	FwyXwy	6,979,018
792	Shelby-PrinArt	PrinArt	6,193,302
793	Shelby-MinArt	MinArt	6,549,334
794	Shelby-Collector	Collector	1,883,997
795	Shelby-LocalRd	LocalRd	3,873,896
842	Tipton-PrinArt	PrinArt	395,441
843	Tipton-MinArt	MinArt	153,347
844	Tipton-Collector	Collector	246,947
845	Tipton-LocalRd	LocalRd	216,119
891	Warren-FwyXwy	FwyXwy	42,652
892	Warren-PrinArt	PrinArt	429,327
893	Warren-MinArt	MinArt	112,386
894	Warren-Collector	Collector	174,786
895	Warren-LocalRd	LocalRd	145,879
941	Williamson-FwyXwy	FwyXwy	3,413,266
942	Williamson-PrinArt	PrinArt	1,394,903
943	Williamson-MinArt	MinArt	584,874
944	Williamson-Collector	Collector	735,365
945	Williamson-LocalRd	LocalRd	1,372,435
TOTAL			116,349,545

County	FHWA DVMT	Formula 3 Weight
Davidson	24,394,388	1.0000
Hamilton	9,720,520	1.0000
Knox	15,889,294	1.0000
Shelby	25,479,548	1.0000
Blount	3,194,163	2.9900
Dyer	1,328,374	7.1896
Loudon	2,315,669	4.1243
McMinn	2,311,164	4.1323
Marion	2,038,315	4.6855
Montgomery	4,612,091	2.0707
Roane	1,990,747	4.7974
Rutherford	9,528,556	1.0023
Sevier	4,128,988	2.3130
Tipton	1,011,855	9.4385
Warren	905,030	10.5526
Williamson	7,500,843	1.2732
TOTAL	116,349,545	

County Tier	FHWA DVMT
Certainty	75,483,750
Random	114,605,234
TOTAL	190,088,984

Appendix B: Jackknife Variance Calculation, 2024 Observational Survey of Seat Belt Use in Tennessee

TENNESSEE SEAT BELT USE -- 2024

ALL VEHICLES

Region		Num Sites	Region/State DVMT$_i$	TOTAL-Male Dvrs		TOTAL-Female Dvrs		TOTAL-All Drivers		TOTAL-Male Psgrs		TOTAL-Female Psgrs		TOTAL-All Psgrs		TOTAL-Male Occs		TOTAL-Female Occs		TOTAL-All Occs	
				p_i	DVMT$_i$*p_i	p_i	DVMT$_i$*p_i	p_i	DVMT$_i$*p_i	p_i	DVMT$_i$*p_i	p_i	DVMT$_i$*p_i	p_i	DVMT$_i$*p_i	p_i	DVMT$_i$*p_i	p_i	DVMT$_i$*p_i	p_i	DVMT$_i$*p_i
1	4 Certain	60	75,483,750	91.3%	68,950,441.4	93.5%	70,591,292.5	92.6%	69,882,486.7	88.8%	67,015,191.4	97.0%	73,236,271.2	93.5%	70,573,829.2	91.1%	68,753,737.8	94.0%	70,959,966.9	92.7%	70,002,288.2
2	12 of 55	130	114,605,234	88.6%	101,545,767.0	97.7%	111,935,135.6	91.8%	105,159,047.9	81.2%	93,102,294.8	98.1%	112,396,653.9	91.6%	104,929,609.7	88.0%	100,888,690.5	97.6%	111,904,013.1	91.8%	105,205,751.9
Total	**Statewide**	**190**	190,088,984	**89.7%**	170,496,208.4	**96.0%**	182,526,428.1	**92.1%**	175,041,534.6	**84.2%**	160,117,486.1	**97.7%**	185,632,925.1	**92.3%**	175,503,438.9	**89.2%**	169,642,428.3	**96.2%**	182,863,979.9	**92.2%**	175,208,040.1

Jackknife Variance Calculation for All Vehicles/All Occupants — ***Tennessee Statewide, April 2024***

State Belt Use = 92.17% — **Std. Error = 0.603%**

Total Obsvd Occs = 28,431 — **Relative Std. Error = 0.655%**

95% Confidence Interval: **Lower Limit = 90.99%** **Upper Limit = 93.35%**

Cars+SUVs+Vans

Region		Num Sites	Region/State DVMTi	C-S-V: Male Dvrs		C-S-V: Female Dvrs		C-S-V: All Drivers		C-S-V: Male Psgrs		C-S-V: Female Psgrs		C-S-V: All Psgrs		C-S-V: Male Occs		C-S-V: Female Occs		C-S-V: All Occs	
				p_i	DVMT$_i$*p_i	p_i	DVMT$_i$*p_i	p_i	DVMT$_i$*p_i	p_i	DVMT$_i$*p_i	p_i	DVMT$_i$*p_i	p_i	DVMT$_i$*p_i	p_i	DVMT$_i$*p_i	p_i	DVMT$_i$*p_i	p_i	DVMT$_i$*p_i
1	4 Certain	60	75,483,750	93.1%	70,309,365.3	93.7%	70,734,678.8	93.9%	70,887,527.4	92.0%	69,413,378.5	97.3%	73,481,181.3	95.6%	72,158,182.2	93.1%	70,261,876.2	94.2%	71,094,014.0	94.2%	71,078,669.9
2	12 of 55	130	114,605,234	92.8%	106,377,718.2	97.8%	112,067,827.5	95.3%	109,201,795.8	92.0%	105,478,927.0	98.3%	112,671,226.7	96.1%	110,187,135.6	92.9%	106,419,535.0	97.9%	112,187,993.7	95.5%	109,476,164.3
Total	**Statewide**	**190**	190,088,984	**92.9%**	176,687,083.6	**96.2%**	182,802,506.3	**94.7%**	180,089,323.1	**92.0%**	174,892,305.5	**97.9%**	186,152,408.0	**95.9%**	182,345,317.8	**92.9%**	176,681,411.2	**96.4%**	183,282,007.7	**95.0%**	180,554,834.2

CARS

Region		Num Sites	Region/State DVMTi	Cars-Male Dvrs		Cars-Female Dvrs		Cars-All Drivers		Cars-Male Psgrs		Cars-Female Psgrs		Cars-All Psgrs		Cars-Male Occs		Cars-Female Occs		Cars-All Occs	
				p_i	DVMT$_i$*p_i	p_i	DVMT$_i$*p_i	p_i	DVMT$_i$*p_i	p_i	DVMT$_i$*p_i	p_i	DVMT$_i$*p_i	p_i	DVMT$_i$*p_i	p_i	DVMT$_i$*p_i	p_i	DVMT$_i$*p_i	p_i	DVMT$_i$*p_i
1	4 Certain	60	75,483,750	94.3%	71,173,454.8	93.1%	70,309,698.5	94.1%	71,045,491.5	94.6%	71,421,578.0	97.7%	73,777,359.4	96.6%	72,933,424.5	94.3%	71,193,083.3	93.8%	70,800,718.2	94.4%	71,274,043.6
2	12 of 55	130	114,605,234	94.0%	107,753,193.9	97.4%	111,624,784.7	95.7%	109,632,167.7	92.1%	105,578,681.8	97.7%	111,946,146.0	95.7%	109,699,147.9	94.0%	107,697,708.2	97.5%	111,703,997.7	95.9%	109,855,099.2
Total	**Statewide**	**190**	190,088,984	**94.1%**	178,926,648.8	**95.7%**	181,934,483.2	**95.0%**	180,677,659.2	**93.1%**	177,000,259.8	**97.7%**	185,723,505.5	**96.1%**	182,632,572.5	**94.1%**	178,890,791.5	**96.0%**	182,504,715.9	**95.3%**	181,129,142.9

Pickup Trucks

Region		Num Sites	Region/State DVMTi	PkUps-Male Dvrs		PkUps-Female Dvrs		PkUps-All Drivers		PkUps-Male Psgrs		PkUps-Female Psgrs		PkUps-All Psgrs		PkUps-Male Occs		PkUps-Female Occs		PkUps-All Occs	
				p_i	DVMT$_i$*p_i	p_i	DVMT$_i$*p_i	p_i	DVMT$_i$*p_i	p_i	DVMT$_i$*p_i	p_i	DVMT$_i$*p_i	p_i	DVMT$_i$*p_i	p_i	DVMT$_i$*p_i	p_i	DVMT$_i$*p_i	p_i	DVMT$_i$*p_i
1	4 Certain	60	75,483,750	87.0%	65,657,338.7	87.7%	66,234,567.2	87.1%	65,753,498.9	86.5%	65,279,291.7	92.0%	69,438,616.6	86.9%	65,618,558.9	86.7%	65,411,109.3	91.5%	69,040,361.1	87.2%	65,808,081.9
2	12 of 55	130	114,605,234	82.3%	94,288,044.9	98.4%	112,755,592.2	83.3%	95,428,343.5	69.8%	79,964,700.3	97.1%	111,258,156.1	79.5%	91,113,072.3	81.1%	92,992,390.9	97.3%	111,474,776.6	82.9%	94,994,497.3
Total	**Statewide**	**190**	190,088,984	**84.1%**	159,945,383.6	**94.2%**	178,990,159.4	**84.8%**	161,181,842.4	**76.4%**	145,243,992.0	**95.1%**	180,696,772.7	**82.5%**	156,731,631.2	**83.3%**	158,403,500.2	**95.0%**	180,515,137.7	**84.6%**	160,802,579.2

SUVs

Region		Num Sites	Region/State DVMTi	SUVs-Male Dvrs		SUVs-Female Dvrs		SUVs-All Drivers		SUVs-Male Psgrs		SUVs-Female Psgrs		SUVs-All Psgrs		SUVs-Male Occs		SUVs-Female Occs		SUVs-All Occs	
				p_i	DVMT$_i$*p_i	p_i	DVMT$_i$*p_i	p_i	DVMT$_i$*p_i	p_i	DVMT$_i$*p_i	p_i	DVMT$_i$*p_i	p_i	DVMT$_i$*p_i	p_i	DVMT$_i$*p_i	p_i	DVMT$_i$*p_i	p_i	DVMT$_i$*p_i
1	4 Certain	60	75,483,750	95.8%	72,298,124.3	96.6%	72,891,102.2	96.0%	72,458,494.6	88.3%	66,638,576.4	98.9%	74,645,315.3	95.7%	72,204,067.3	95.2%	71,896,804.1	96.9%	73,139,130.3	96.0%	72,483,706.1
2	12 of 55	130	114,605,234	94.1%	107,900,350.6	98.7%	113,152,293.3	96.1%	110,186,328.8	97.0%	111,154,671.0	99.1%	113,530,177.4	98.4%	112,720,076.2	94.3%	108,064,299.8	98.7%	113,128,637.3	96.5%	110,573,293.5
Total	**Statewide**	**190**	190,088,984	**94.8%**	180,198,474.9	**97.9%**	186,043,395.5	**96.1%**	182,644,823.3	**93.5%**	177,793,247.4	**99.0%**	188,175,492.7	**97.3%**	184,924,143.5	**94.7%**	179,961,103.9	**98.0%**	186,267,767.6	**96.3%**	183,056,999.6

Vans

Region		Num Sites	Region/State DVMTi	Vans-Male Dvrs		Vans-Female Dvrs		Vans-All Drivers		Vans-Male Psgrs		Vans-Female Psgrs		Vans-All Psgrs		Vans-Male Occs		Vans-Female Occs		Vans-All Occs	
				p_i	DVMT$_i$*p_i	p_i	DVMT$_i$*p_i	p_i	DVMT$_i$*p_i	p_i	DVMT$_i$*p_i	p_i	DVMT$_i$*p_i	p_i	DVMT$_i$*p_i	p_i	DVMT$_i$*p_i	p_i	DVMT$_i$*p_i	p_i	DVMT$_i$*p_i
1	4 Certain	60	75,483,750	87.0%	65,646,337.9	95.4%	72,024,840.1	89.2%	67,362,629.0	91.4%	69,024,698.3	90.5%	68,277,514.8	93.0%	70,193,682.6	87.2%	65,830,395.1	94.4%	71,294,084.6	89.4%	67,480,114.7
2	12 of 55	130	114,605,234	83.8%	96,003,226.0	96.7%	110,818,033.2	89.4%	102,485,446.6	87.9%	100,735,829.8	98.7%	113,124,050.4	95.4%	109,281,320.7	84.7%	97,074,307.1	96.3%	110,316,806.8	90.2%	103,427,870.1
Total	**Statewide**	**190**	190,088,984	**85.0%**	161,649,563.9	**96.2%**	182,842,873.3	**89.4%**	169,848,075.6	**89.3%**	169,760,528.1	**95.4%**	181,401,565.2	**94.4%**	179,475,003.3	**85.7%**	162,904,702.2	**95.5%**	181,610,891.4	**89.9%**	170,907,984.7

Appendix C: Data Collection Forms, Site Descriptions, Observation Site Maps, Site Schedules, and Other Materials Used by Survey Observation Team

2024 Seat Belt Observer Instructions

The quick version:

- All sites have been reselected for 2022. Even if the site location is similar to one used in recent years, please review the maps, site descriptions, and site schedules closely to ensure that you are in the correct location at the correct time.
- Observe belt use of drivers and outboard front seat passengers only. We can only see the shoulder strap in most vehicles, so occupants without a seat belt visible across their chest will be recorded as unbelted.
- All sites have a designated direction of travel. Observe vehicles in all lanes that travel in this direction (not just the lane closest to you). You may observe traffic in both directions on very-low-volume local roads (75-minute sites)
- Use only the designated observation segments. If you're not sure you have the right location or if there is a problem at the designated location, contact Matt Cate for further instructions
- Each site has a designated time slot for seat belt observations. Do not deviate significantly from these time slots if possible.
- Always record the site name (County #-#) on every observation form used. This is very important as this is the only way we can pair observation data with the correct site if the pages are shuffled or separated.

These instructions describe procedures for observing seat belts and motorcycle helmet use, including where to stand at an intersection, what to look for, and coding. Please keep these instructions handy for quick review.

1. Observation Sites

These sites are all new. Matt has reviewed each site carefully and the gold stars on the map indicate a suggested/preferred observation location. Please use these locations if possible. However, if you determine that the suggested observation location is unusable due to safety concerns or time-specific light/glare issues, please select a new observation location. The new location must be located along the green line as shown on the site map. Mark the approximate location of the alternate observation site on the printed map and return this to Matt so that the printed maps can be updated ahead of the next site visit.

You will be given a general map of the road segment on which you are to observe (together with the time and day of week for observation). A point along the segment will be identified as the preferred location for seat belt use observation, as well as the direction of travel to observe. If this direction would be very much harder to observe than the other, either because of safety issues for you or traffic or for observation problems such as sun glare, choose the other direction. If you change the direction to be observed, record the reason on the Field Data Form.

Next, find a specific location for observing. The general map will show the length of road, or identify possible highway exit ramps, on which observations can be made. Select a spot where you can observe safely, without risk to yourself or to traffic (e.g., by being a distraction or by impeding their view), and where you can readily observe the belt use of drivers and outboard front seat passengers.

It is recommended that you first look for a place where traffic must slow naturally, for a traffic control (stop signs are better than traffic signals) or a sharp curve on an expressway exit ramp.

When you have selected the exact location for observing, show the location on your general map and then make a detailed "site map" – a drawing that shows where to stand, the traffic flow you're observing, the names of the intersecting roadways, nearby buildings, etc. – on the Field Map Form.

2. Observation Days and Times

You will receive a schedule that has assigned observation locations with day of week and time of day. You must adhere to this schedule if at all possible. (Observe in poor weather as long as you can stay dry (enough) and your ability to make accurate judgments is not compromised.)

You need to observe for 45 minutes at each site (75 minutes at each Local Road site). The observation period should be continuous and should fall entirely within the observation period. Use the extra time in observation periods to move between sites, load and unload observation gear, locate and document your observation positions, eat snacks, etc.

3. List of Sites

In your packet of materials is your list of observation sites, together with maps, descriptive information (road names, cross streets, etc.) and day-of-week and time-of-day schedule.

4. What to Do if a Site Is Unusable/Inaccessible

Alternate sites with the same information are also provided. If you determine that the primary site cannot be used, you must call your supervisor to obtain an alternate site. The alternate will be in the same county and of the same roadway type ("stratum").

If you must use an alternate site, indicate on the general map for the primary site why you can't use it. Then go on with your schedule. The alternate site must be observed on the same day of the week and time of day as the site you had to abandon. If you can observe there "today" in the proper time period, do so; if not, schedule it for a coming week.

5. Which Roadway and Direction to Observe

It is important to recognize that one can<u>not</u> simply choose to observe traffic on either of the intersecting roadways at an intersection. The roadway and the direction to observe are clearly indicated on the general site map and in your site schedule. You must observe traffic on this roadway traveling in the indicated direction (unless you had to change directions in Step 1).

6. Which Vehicles to Observe

a. **Passenger vehicles**. Code passenger cars, pickup trucks, sport utility vehicles (SUVs), and vans that are less than 10,000 GVWR. Include private, commercial, and emergency vehicles if they fit one of the previous categories. **Include** modified vehicles, such as campers, RVs, and ambulances, which clearly started as one of the passenger vehicle categories like pickups or vans. **Exclude** large buses, heavy trucks, farm equipment, etc.

b. You will have selected an observation point where you expect you will be able to code nearly every qualified vehicle. If you are near a stop-sign-controlled intersection (or a roundabout, or some other location where all traffic is slowed), or on a roadway where traffic speeds and volumes are moderate, this is realistic. If you are near a signal-controlled intersection, you may find that free-flowing traffic on the green signal is moving too fast. In that case, go to step (c). The goal is to have very few "unsures".

c. If you need to observe traffic stopped/slowed by a red light, begin observations with the **second** vehicle in a line of vehicles stopped at the traffic signal (first vehicle if there is only one). Code restraint use by occupants of that vehicle, then code the next vehicle in line, etc. Continue until the vehicles begin to move too rapidly with the green signal.

d. On surface streets with multiple lanes of approaching traffic, code traffic from all lanes if possible. If you are observing at a signal-controlled intersection, begin with the second vehicle in the near lane (first if only one vehicle stopped), then the second in the next lane, etc., to the third in the near lane, etc. For the next red signal, begin with the second (first, if only) vehicle in the lane you left off at on the preceding signal phase.

e. In the case of freeway exits, find a location controlled by a sharp turn, a stop sign, or a traffic signal so that you can observe nearly all vehicles that slow down. If possible, do not choose a location where the only vehicles that slow down are ones that can't merge smoothly, since that would bias your selection to that category of drivers.

f. **Motorcycles**: We no longer record helmet use for motorcycle riders.

7. Heavy Traffic Conditions

It is possible that, in heavy traffic conditions, there is an "unending" line of vehicles in the flow of traffic. In this situation, **use a reference point** to randomly determine which is your next vehicle up the road to observe regardless of lane. Pick your reference point some distance up the road. The next vehicle to pass the point is the next vehicle to observe. In other words, after recording data for the current vehicle, look up and record data for the next qualified vehicle passing your reference point.

8. How Long to Observe

Remain observing at each site for 45 minutes (75 minutes for Local Roads). A fixed observation period translates to high volume roadways contributing more observation data than low volume roadways.

9. Observing in Bad Weather.

Do not observe if it is raining too hard or other inclement weather arises. If you arrive at a site and it begins to rain, do not collect data in the rain. Find a dry place and wait 15 minutes to see if the rain stops. If the rain does stop, begin observing again and extend the observation period to make up for the time missed. Otherwise, you will have to reschedule the site (same time of day and day of week). (Note: Observer may continue observations in light fog, drizzle, or mist.)

10. Whom to Observe

Front seat drivers and outboard passengers. If there are more than two occupants in the front seat, only observe the driver and the passenger (regardless of age) closest to the passenger-side door. Thus, if there are three occupants in the front seat, you would ignore the middle occupant. Do not record children who are in child restraint seats; record all other children in the outboard passenger position, even those in booster seats.

10. What to Observe

a. **All**. As you observe a qualifying vehicle, record the type of vehicle (1=car, 2=truck, 3=SUV, 4=van, 5=motorcycle) and the sex (1=male, 2=female, 3=unsure), and shoulder restraint use (1=yes, 2=no, 3=unsure) of the front seat occupants (driver and front seat "outside" passenger only) or helmet use (1=yes, 2=no, 3=unsure) of motorcyclists.
b. **Front seat drivers and outboard passengers**. Code restrained (1=yes) if you see a shoulder belt in the proper position across the front of the person. If you notice a lap belt in use without a

shoulder belt, it should be recorded as not restrained (2=no). Only shoulder belts are to be counted. Even if the vehicle likely has no shoulder belts, code the occupant(s) as not restrained. If the person is using the shoulder belt improperly, e.g., has the shoulder strap under his/her arm or behind the back, this should be recorded as not restrained. Code unsure (3) only if you cannot tell whether a shoulder belt is properly used.

11. Returning Materials After Completing Observations

Make sure to return all materials back to your supervisor.

a. Completed coding forms (please staple all forms from the same site together in order)
b. Field Map Forms (with any changes noted – only after the last survey)
c. County maps (with any changes noted – only after the last survey)

12. General Tips

Conducting seat belt observations is not particularly hard work, but it is tedious and demanding work. Conditions are often hot and humid in the summer and cold and wet in the winter. Observers must make a special effort to maintain the quality of the observations. Here are some tips and recommendations based on years of conducting these observations.

1. Dress for the work. In the summertime, a hat, sunscreen and sunglasses are essential. If you don't have the complexion that will allow several hours in the sun, you should wear long pants and long-sleeved shirts. The discomfort that comes with the heat is much more bearable (and considerably shorter) than a severe sunburn. If you are out in cold weather, wear layers of clothing and take care of your feet, hands, and head with proper foot, hand, and headgear.

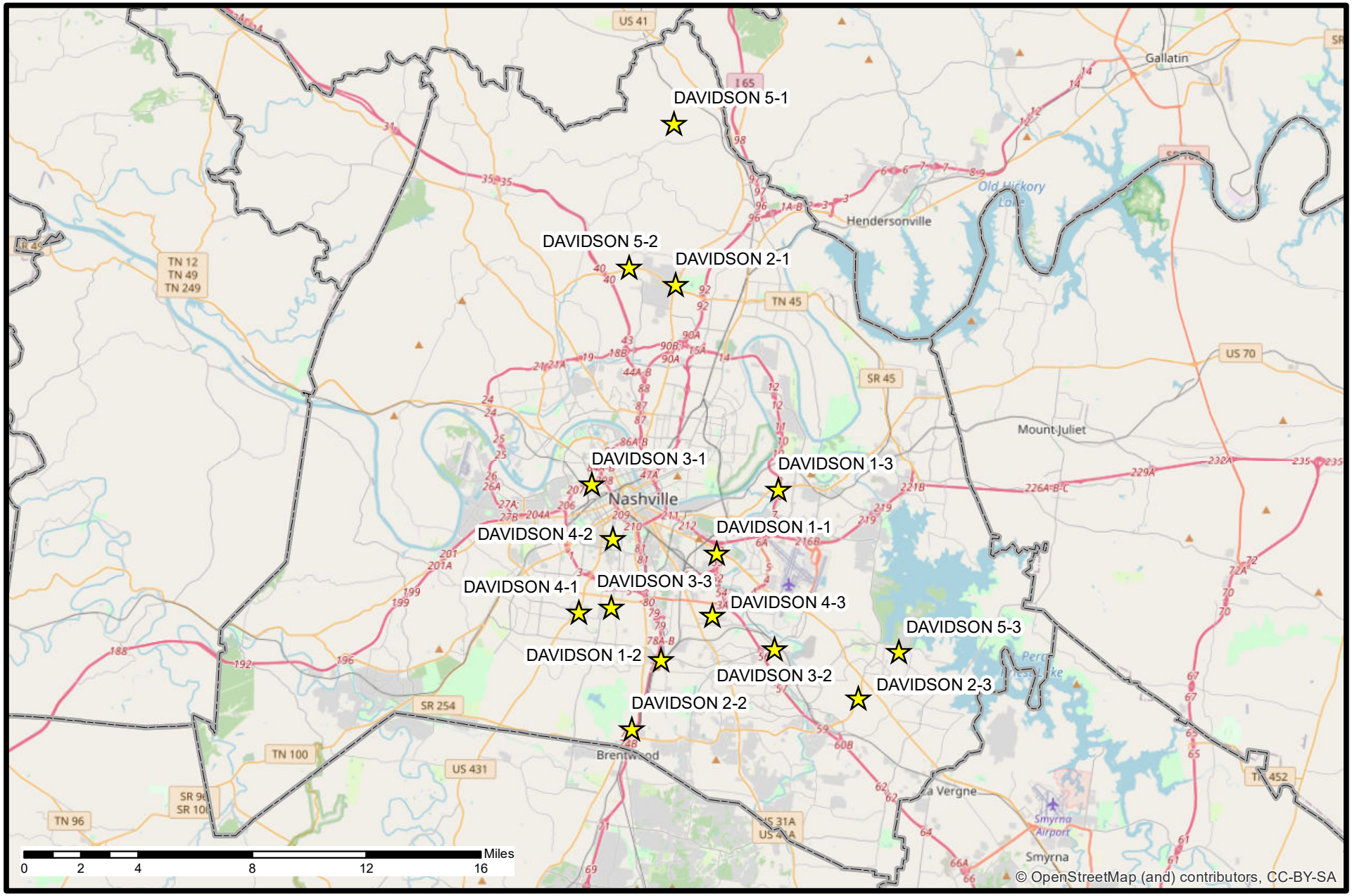
2. Wear an orange or yellow safety vest at all times. Drivers are wary of people hanging around corners peering into cars, especially if they have kids in the car. The vest gives you an "official" air that may put drivers at ease. Still, don't be insulted by windows going up, doors locking, etc.

3. Keep the identification project letter handy. Keep contact names and numbers of our local police contacts (these officials know you are there conducting research).

4. Patrolling police officers and others will likely not be aware of the project. If anyone asks what is being done, explain it to them and show them the letter.

5. Be thoroughly familiar with all the data collection procedures. Just one person consistently making the same mistakes can bias the results. The point of this research is to get an accurate reading of seat belt usage so education campaigns can be developed for low usage groups. Accurate information is of paramount importance.

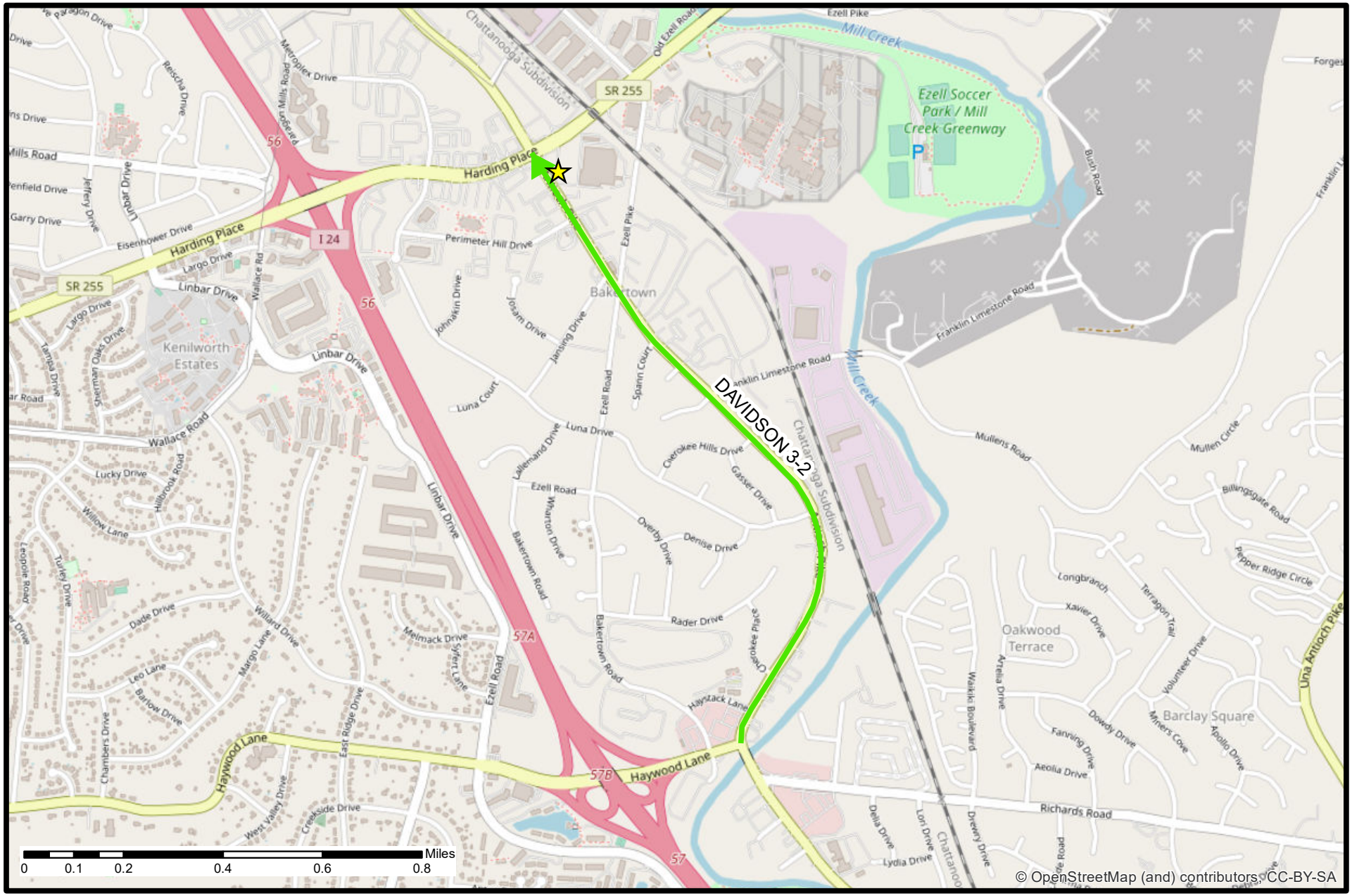
6. Each observer is ultimately responsible for his/her work, as well as safety. Remember, observation requires that you stand close to traffic. Stay alert and be ready to react.



CTR

Davidson County Obervation Site Overview Map

Prepared April 20, 2022



CTR

Site Name: DAVIDSON 3-2
Road Name: ANTIOCH PK.
State Route: 04169
US Route: --

Observe Direction: NB or EB
Duration (mins): 45
Map Date: 4/20/2022

Site Name	Site Number	Roadway Name	State Route	US Route	Begin Log Mile	End Log Mile	Length (miles)	Observation Direction	Minutes	Notes
DAVIDSON 1-1	12	I-24	I0024	--	16.06	17.2	1.14	NB or EB	45	I-24 WB onramp from Murfreesboro Pike/US 41 SB
DAVIDSON 1-2	13	I-65	I0065	--	1.44	2.52	1.08	NB or EB	45	I-65 NB offramp at Exit 78
DAVIDSON 1-3	14	BRILEY PKWY.	SR155	--	7.06	8.26	1.2	SB or WB	45	Briley Parkway SB onramp from Lebanon Pike EB
DAVIDSON 2-1	15	DICKERSON PK.	SR011	31W	19.4	22.095	2.695	SB or WB	45	Strip center parking lot north of Sonic
DAVIDSON 2-2	16	FRANKLIN PK.	SR006	31	0.617	2.29	1.673	SB or WB	45	
DAVIDSON 2-3	17	BELL RD.	SR254	--	15.49	17.29	1.8	SB or WB	45	At Hickory Hollow Baptist Church
DAVIDSON 3-1	18	DR. D.B. TODD JR. BLVD.	03295	--	1.29	2.269	0.979	NB or EB	45	
DAVIDSON 3-2	19	ANTIOCH PK.	04169	--	3.14	4.57	1.43	NB or EB	45	Sam's Club
DAVIDSON 3-3	20	GRANNY WHITE PK.	03248	--	3.324	5.26	1.936	NB or EB	45	Parking Lot - Church of Christ in Green Hills
DAVIDSON 4-1	21	RICHARD JONES RD.	04882	--	0	0.331	0.331	NB or EB	45	
DAVIDSON 4-2	22	16TH AVE. S.	03245	--	0	0.731	0.731	NB or EB	45	On-street parking
DAVIDSON 4-3	23	SOUTHLAKE DR.	04946	--	0	0.63	0.63	SB or WB	45	at Southlake Court
DAVIDSON 5-1	24	FREEMAN HOLLOW RD.	0D452	--	0	1.678	1.678	NB or EB	75	at Freeman Hollow Court
DAVIDSON 5-2	25	BRICK CHURCH PK.	0D460	--	1.889	3.052	1.163	NB or EB	75	
DAVIDSON 5-3	26	CASTLEGATE DR.	0B122	--	0	0.842	0.842	NB or EB	75	at Castlegate Circle

2022 Seat Belt Observation Site Schedule

County	Time Zone	Day	No. Sites	1st Site	Time Slot	2nd Site	Time Slot	3rd Site	Time Slot	4th Site	Time Slot	5th Site	Time Slot	6th Site	Time Slot
Blount	Eastern	1	6	3-1	7:00 AM - 8:45 AM	3-2	8:45 AM - 10:30 AM	4-1	10:30 AM - 12:15 PM	4-2	12:15 PM - 2:30 PM	5-2	2:30 PM - 4:15 PM	2-2	4:15 PM - 6:00 PM
Blount	Eastern	2	5	1-1	7:00 AM - 9:00 AM	1-2	9:00 AM - 11:00 AM	2-1	11:00 AM - 2:00 PM	5-1	2:00 PM - 4:00 PM	5-3	4:00 PM - 6:00 PM	NA	NA
Davidson	Central	1	5	1-1	7:00 AM - 9:00 AM	4-3	9:00 AM - 11:00 AM	3-2	11:00 AM - 2:00 PM	2-3	2:00 PM - 4:00 PM	5-3	4:00 PM - 6:00 PM	NA	NA
Davidson	Central	2	5	4-2	7:00 AM - 9:00 AM	4-1	9:00 AM - 11:00 AM	3-3	11:00 AM - 2:00 PM	1-2	2:00 PM - 4:00 PM	2-2	4:00 PM - 6:00 PM	NA	NA
Davidson	Central	3	5	1-3	7:00 AM - 9:00 AM	3-1	9:00 AM - 11:00 AM	2-1	11:00 AM - 2:00 PM	5-2	2:00 PM - 4:00 PM	5-1	4:00 PM - 6:00 PM	NA	NA
Dyer	Central	1	6	2-2	7:00 AM - 8:45 AM	1-2	8:45 AM - 10:30 AM	4-2	10:30 AM - 12:15 PM	5-4	12:15 pm - 2:30 PM	2-1	2:30 PM - 4:15 PM	3-2	4:15 PM - 6:00 PM
Dyer	Central	2	5	1-1	7:00 AM - 9:00 AM	4-1	9:00 AM - 11:00 AM	5-3	11:00 AM - 2:00 PM	3-1	2:00 PM - 4:00 PM	5-2	4:00 PM - 6:00 PM	NA	NA
Hamilton	Eastern	1	5	2-3	7:00 AM - 9:00 AM	4-2	9:00 AM - 11:00 AM	4-3	11:00 AM - 2:00 PM	3-3	2:00 PM - 4:00 PM	4-1	4:00 PM - 6:00 PM	NA	NA
Hamilton	Eastern	2	5	2-2	7:00 AM - 9:00 AM	3-2	9:00 AM - 11:00 AM	1-2	11:00 AM - 2:00 PM	1-1	2:00 PM - 4:00 PM	5-1	4:00 PM - 6:00 PM	NA	NA
Hamilton	Eastern	3	5	5-2	7:00 AM - 9:00 AM	1-4	9:00 AM - 11:00 AM	3-1	11:00 AM - 2:00 PM	2-1	2:00 PM - 4:00 PM	5-3	4:00 PM - 6:00 PM	NA	NA
Knox	Eastern	1	5	4-2	7:00 AM - 9:00 AM	1-2	9:00 AM - 11:00 AM	1-3	11:00 AM - 2:00 PM	2-3	2:00 PM - 4:00 PM	2-4	4:00 PM - 6:00 PM	NA	NA
Knox	Eastern	2	5	5-1	7:00 AM - 9:00 AM	3-3	9:00 AM - 11:00 AM	5-3	11:00 AM - 2:00 PM	3-2	2:00 PM - 4:00 PM	4-1	4:00 PM - 6:00 PM	NA	NA
Knox	Eastern	3	5	4-3	7:00 AM - 9:00 AM	2-1	9:00 AM - 11:00 AM	1-1	11:00 AM - 2:00 PM	3-1	2:00 PM - 4:00 PM	5-2	4:00 PM - 6:00 PM	NA	NA
Loudon	Eastern	1	5	2-1	7:00 AM - 9:00 AM	2-2	9:00 AM - 11:00 AM	4-1	11:00 AM - 2:00 PM	4-2	2:00 PM - 4:00 PM	5-5	4:00 PM - 6:00 PM	NA	NA
Loudon	Eastern	2	6	3-1	7:00 AM - 8:45 AM	5-1	8:45 AM - 10:30 AM	1-1	10:30 AM - 12:15 PM	3-2	12:15 pm - 2:30 PM	5-2	2:30 PM - 4:15 PM	1-2	4:15 PM - 6:00 PM
McMinn	Eastern	1	5	4-2	7:00 AM - 9:00 AM	3-1	9:00 AM - 11:00 AM	2-1	11:00 AM - 2:00 PM	5-3	2:00 PM - 4:00 PM	5-1	4:00 PM - 6:00 PM	NA	NA
McMinn	Eastern	2	6	3-2	7:00 AM - 8:45 AM	1-2	8:45 AM - 10:30 AM	1-1	10:30 AM - 12:15 PM	4-1	12:15 pm - 2:30 PM	5-2	2:30 PM - 4:15 PM	2-2	4:15 PM - 6:00 PM
Marion	Central	1	6	4-1	7:00 AM - 8:45 AM	1-1	8:45 AM - 10:30 AM	1-2	10:30 AM - 12:15 PM	3-2	12:15 pm - 2:30 PM	5-4	2:30 PM - 4:15 PM	2-1	4:15 PM - 6:00 PM
Marion	Central	2	5	4-2	7:00 AM - 9:00 AM	2-2	9:00 AM - 11:00 AM	3-1	11:00 AM - 2:00 PM	5-1	2:00 PM - 4:00 PM	5-3	4:00 PM - 6:00 PM	NA	NA
Montgomery	Central	1	5	1-2	7:00 AM - 9:00 AM	1-1	9:00 AM - 11:00 AM	4-1	11:00 AM - 2:00 PM	5-3	2:00 PM - 4:00 PM	5-4	4:00 PM - 6:00 PM	NA	NA
Montgomery	Central	2	6	3-1	7:00 AM - 8:45 AM	2-2	8:45 AM - 10:30 AM	4-2	10:30 AM - 12:15 PM	2-1	12:15 PM - 2:30 PM	3-2	2:30 PM - 4:15 PM	5-1	4:15 PM - 6:00 PM
Roane	Eastern	1	6	4-1	7:00 AM - 8:45 AM	3-2	8:45 AM - 10:30 AM	3-1	10:30 AM - 12:15 PM	2-1	12:15 PM - 2:30 PM	4-2	2:30 PM - 4:15 PM	5-1	4:15 PM - 6:00 PM
Roane	Eastern	2	5	5-3	7:00 AM - 9:00 AM	2-2	9:00 AM - 11:00 AM	1-1	11:00 AM - 2:00 PM	5-2	2:00 PM - 4:00 PM	1-2	4:00 PM - 6:00 PM	NA	NA
Rutherford	Central	1	6	4-2	7:00 AM - 8:45 AM	3-1	8:45 AM - 10:30 AM	3-2	10:30 AM - 12:15 PM	1-2	12:15 pm - 2:30 PM	5-2	2:30 PM - 4:15 PM	2-1	4:15 PM - 6:00 PM
Rutherford	Central	2	5	1-1	7:00 AM - 9:00 AM	4-1	9:00 AM - 11:00 AM	5-1	11:00 AM - 2:00 PM	2-2	2:00 PM - 4:00 PM	5-3	4:00 PM - 6:00 PM	NA	NA
Sevier	Eastern	1	5	5-3	7:00 AM - 9:00 AM	5-2	9:00 AM - 11:00 AM	4-1	11:00 AM - 2:00 PM	4-2	2:00 PM - 4:00 PM	3-1	4:00 PM - 6:00 PM	NA	NA
Sevier	Eastern	2	6	2-2	7:00 AM - 8:45 AM	5-1	8:45 AM - 10:30 AM	3-2	10:30 AM - 12:15 PM	1-1	12:15 PM - 2:30 PM	1-2	2:30 PM - 4:15 PM	2-1	4:15 PM - 6:00 PM
Shelby	Central	1	5	2-1	7:00 AM - 9:00 AM	5-4	9:00 AM - 11:00 AM	5-2	11:00 AM - 2:00 PM	4-3	2:00 PM - 4:00 PM	2-2	4:00 PM - 6:00 PM	NA	NA
Shelby	Central	2	5	1-3	7:00 AM - 9:00 AM	1-1	9:00 AM - 11:00 AM	5-3	11:00 AM - 2:00 PM	1-2	2:00 PM - 4:00 PM	3-1	4:00 PM - 6:00 PM	NA	NA
Shelby	Central	3	5	4-1	7:00 AM - 9:00 AM	3-2	9:00 AM - 11:00 AM	2-3	11:00 AM - 2:00 PM	3-3	2:00 PM - 4:00 PM	4-2	4:00 PM - 6:00 PM	NA	NA
Tipton	Central	1	5	5-1	7:00 AM - 9:00 AM	4-1	9:00 AM - 11:00 AM	2-1	11:00 AM - 2:00 PM	3-1	2:00 PM - 4:00 PM	5-2	4:00 PM - 6:00 PM	NA	NA
Tipton	Central	2	5	4-2	7:00 AM - 9:00 AM	2-2	9:00 AM - 11:00 AM	2-3	11:00 AM - 2:00 PM	3-2	2:00 PM - 4:00 PM	5-3	4:00 PM - 6:00 PM	NA	NA
Warren	Central	1	5	2-2	7:00 AM - 9:00 AM	4-2	9:00 AM - 11:00 AM	4-1	11:00 AM - 2:00 PM	2-1	2:00 PM - 4:00 PM	3-1	4:00 PM - 6:00 PM	NA	NA
Warren	Central	2	5	3-2	7:00 AM - 9:00 AM	5-3	9:00 AM - 11:00 AM	5-5	11:00 AM - 2:00 PM	5-2	2:00 PM - 4:00 PM	1-1	4:00 PM - 6:00 PM	NA	NA
Williamson	Central	1	5	4-2	7:00 AM - 9:00 AM	1-3	9:00 AM - 11:00 AM	4-1	11:00 AM - 2:00 PM	2-1	2:00 PM - 4:00 PM	5-1	4:00 PM - 6:00 PM	NA	NA
Williamson	Central	2	6	3-1	7:00 AM - 8:45 AM	2-2	8:45 AM - 10:30 AM	1-1	10:30 AM - 12:15 PM	3-2	12:15 pm - 2:30 PM	5-2	2:30 PM - 4:15 PM	5-3	4:15 PM - 6:00 PM

Tennessee Seat Belt Observation Form

COUNTY:_____ **SITE NO./DESCRIPTION:** _____

NOTES: _____

DATE: ____-____-____ DAY OF WEEK _____

WEATHER CONDITIONS (circle)

1 clear **4 fog**
2 light rain **5 wet but not**
3 cloudy **raining**

DIRECTION OF TRAFFIC FLOW OBSERVED (circle one): N S E W

START TIME: _____ END TIME: _____

(Observation period will last exactly 75 minutes for local road sites, 45 minutes for all others)

	DRIVER			PASSENGER				DRIVER			PASSENGER	
Vehicle #	**Vehicle** C=car T=truck S=suv V=van	**Sex** M=male F=female U=unsure	**Belt Use** Y=yes N=no U=unsure	**Sex** M=male F=female U=unsure ?? Unsure if present	**Belt Use** Y=yes N=no U=unsure		**Vehicle #**	**Vehicle** C=car T=truck S=suv V=van	**Sex** M=male F=female U=unsure	**Belt Use** Y=yes N=no U=unsure	**Sex** M=male F=female U=unsure ?? Unsure if present	**Belt Use** Y=yes N=no U=unsure
1							36					
2							37					
3							38					
4							39					
5							40					
6							41					
7							42					
8							43					
9							44					
10							45					
11							46					
12							47					
13							48					
14							49					
15							50					
16							51					
17							52					
18							53					
19							54					
20							55					
21							56					
22							57					
23							58					
24							59					
25							60					
26							61					
27							62					
28							63					
29							64					
30							65					
31							66					
32							67					
33							68					
34							69					
35							70					

Appendix D: Proposal for Tennessee Observational Surveys of Safety Belt and Motorcycle Helmet Use, Version 1.2 (Approved by NHTSA on April 12, 2012)

PROPOSAL FOR TENNESSEE OBSERVATIONAL SURVEYS OF SAFETY BELT AND MOTORCYCLE HELMET USE

Version 1.2

Project Agency:
The University of Tennessee

Prepared by:
Dr. Stephen H. Richards
Associate Professor
The University of Tennessee

Dr. William A. Leaf
Senior Associate
Preusser Research Group, Inc.

Matthew A. Cate, P.E.
Research Associate III
The University of Tennessee

Submitted for Approval:
April 3, 2012

Approved by NHTSA:
April 12, 2012

Table of Contents

TENNESSEE OBSERVATIONAL SURVEYS OF SAFETY BELT AND MOTORCYCLE HELMET USE

1. Introduction

This document is a detailed description of the methodology proposed for use, beginning in 2012, in the State of Tennessee observational surveys of safety belt and motorcycle helmet use. The sample design, data collection techniques, and estimation procedures for the surveys have been developed in accordance with NHTSA's "Uniform Criteria for State Observational Survey of Seat Belt Use," published in the April 1, 2011, Federal Register (23 CRF Part 1340, pp. 18056-18059).

In Tennessee, a statewide, scientifically designed survey is conducted each year in the spring or early summer, at which time both safety belt and motorcycle helmet use data are gathered simultaneously. The current design for this annual survey was developed by these authors in 2008, based on the 2000 NHTSA criteria, and includes 160 observation sites across 16 counties. This annual survey is currently administered, analyzed, and documented by the University of Tennessee Center for Transportation Research. The primary contact person at the Center is Mr. Matthew Cate (865/974-5255, mcate@utk.edu).

This proposal is a modification of the current design to reflect the 2011 update of NHTSA criteria. This proposal is based on 16 counties and 190 total observation sites.

The sampling procedures described herein utilize data from the Tennessee Roadway Information Management System (TRIMS) compiled by the Tennessee Department of Transportation (TDOT) and 2005-2009 Fatality Analysis Records System (FARS) passenger vehicle occupant fatalities by county. The FARS data show 4,465 passenger vehicle occupant fatalities in 2005-2009, decreasing from 1,010 in 2005 to 955 in 2006, 928 in 2007, 783 in 2008, and just 749 in 2009.[1, 2]

The TRIMS file also provides a "population" of observation segments for the surveys. TRIMS contains data on all of roadways making up the 91,000-mile public road system in Tennessee, including Interstate Highways and Expressways, Principal and Minor Arterials, Major and Minor Collectors, and Local Roads. As part of these data, each roadway is broken down into several "control sections," or segments, which vary from less than a mile to a few miles in length. These route segments tend to be homogeneous with regard to traffic volumes, land use, function, speeds, etc. Segment beginning and ending termini, road functional classification, and location of

[1] The TRIMS file was provided by TDOT in November 2011. It is the primary source for HPMS reporting. The data found in this table are submitted to and reviewed by the Federal Highway Administration on an annual basis. All physical characteristics about the roadway facilities in this table are field verified on a cyclical basis. According to TDOT, the data were accurate at the time the file was downloaded.

[2] All FARS data taken from the FARS website: For passenger car occupant fatalities, http://www-nrd.nhtsa.dot.gov/departments/nrd-30/ncsa/STSI/28_MS/2009/Tennessee_Map_13_DATA_2009.PDF; for light truck and van occupant fatalities, http://www-nrd.nhtsa.dot.gov/departments/nrd-30/ncsa/STSI/28_MS/2009/Tennessee_Map_14_DATA_2009.PDF; accessed 11/21/2011.

intersecting roadways are recorded in the TRIMS file for each road segment. An AADT estimate is provided for all road segments larger than local roads and for a small sample of local roads.

The survey statistician is Dr. William A. Leaf. Dr. Leaf has extensive experience in behavioral research design, conduct, and evaluation, with particular emphasis in the area of highway safety. In the past, he has taken the lead in the design of numerous Section 157-compliant seat belt use surveys, including but not limited to those currently in use by Connecticut, Florida, Maine, Mississippi, Pennsylvania, and Tennessee; he is now designing several updates to meet the new criteria. His Ph.D. is from Yale University, with a major in experimental social psychology and a minor in experimental design.

2. Survey Design

A multi-stage area PPS (probability proportional to size) sampling approach is used in the proposed survey design. In the first stage, primary sampling units are PPS randomly selected. The primary sampling unit for the Tennessee survey is the county. Tennessee has a total of 95 counties. The 59 counties shown in Table 1 together account for 85% of the state's passenger vehicle occupant fatalities and, consistent with NHTSA guidelines, are considered eligible for including in the final belt use design. They are the counties with the most passenger vehicle occupant fatalities in 2005-2009 except for Coffee County, whose 63 fatalities would rank it 17th among all counties. In early June of each year, when the state seat belt use survey is normally conducted, Coffee County is host to the Bonnaroo Music Festival, which brings roughly 100,000 young fans into the area. This crowd is atypical of normal Coffee County traffic and might distort the observed belt use rate. Therefore, we choose to exclude Coffee County from the list of counties which could be sampled. Table 1 shows a listing of the 59 counties with the most passenger vehicle occupant fatalities, ordered by decreasing numbers of passenger vehicle occupant fatalities, again excluding Coffee County. Also shown are 2010 total DVMT (Daily Vehicle Miles Traveled) values and their percentage of the statewide total DVMT.[3] Finally, Table 1 shows the probability of inclusion in the final sample of 16 counties according to the procedures described below. The proposed sample of 16 counties is highlighted.

Attachment 1 contains the same information, excluding sample selection probabilities, for the remaining 36 counties, i.e., Coffee County plus the 35 counties with the fewest passenger vehicle occupant fatalities.

[3] DVMT values from the 2010 TN HPMS county DVMT table, **2010 TN HPMSCntyDVMT.pdf.**

Table 1. 59 Top-85% Counties, Ordered by Passenger Vehicle Occupant Fatalities, 2005-2009

County	Region	Select?	N Fatal	% all TN	Cum %	Total DVMT[1]	% all TN	Cum %	Prob Seln
Shelby	**4-West**	**Certain**	**397**	**8.9%**	**8.9%**	**23,353,266**	**12.1%**	**12.1%**	**1.0000**
Davidson	**3-Central**	**Certain**	**285**	**6.4%**	**15.3%**	**21,385,606**	**11.1%**	**23.2%**	**1.0000**
Knox	**1-Northeast**	**Certain**	**249**	**5.6%**	**20.9%**	**14,791,379**	**7.7%**	**30.9%**	**1.0000**
Hamilton	**2-Southeast**	**Certain**	**153**	**3.4%**	**24.3%**	**9,765,073**	**5.1%**	**35.9%**	**1.0000**
Rutherford	**3-Central**	**Random**	**123**	**2.8%**	**27.0%**	**7,925,313**	**4.1%**	**40.0%**	**0.9017**
Montgomery	**3-Central**	**Random**	**88**	**2.0%**	**29.0%**	**3,923,956**	**2.0%**	**42.1%**	**0.4464**
Madison	4-West	No	85	1.9%	30.9%	3,822,354	2.0%	44.0%	0.4349
Sullivan	1-Northeast	No	82	1.8%	32.7%	4,273,430	2.2%	46.2%	0.4862
Sevier	**1-Northeast**	**Random**	**80**	**1.8%**	**34.5%**	**3,566,986**	**1.8%**	**48.1%**	**0.4058**
Sumner	3-Central	No	77	1.7%	36.3%	4,000,127	2.1%	50.2%	0.4551
Greene	1-Northeast	No	76	1.7%	38.0%	2,364,020	1.2%	51.4%	0.2690
Robertson	3-Central	No	70	1.6%	39.5%	2,711,201	1.4%	52.8%	0.3085
Wilson	3-Central	No	70	1.6%	41.1%	4,076,913	2.1%	54.9%	0.4638
Hawkins	1-Northeast	No	67	1.5%	42.6%	1,231,253	0.6%	55.6%	0.1401
Maury	3-Central	No	67	1.5%	44.1%	2,619,197	1.4%	56.9%	0.2980
Putnam	2-Southeast	No	64	1.4%	45.5%	2,899,372	1.5%	58.4%	0.3299
Washington	1-Northeast	No	62	1.4%	46.9%	3,112,894	1.6%	60.0%	0.3542
McMinn	**2-Southeast**	**Random**	**60**	**1.3%**	**48.3%**	**2,066,709**	**1.1%**	**61.1%**	**0.2351**
Blount	**1-Northeast**	**Random**	**59**	**1.3%**	**49.6%**	**3,005,088**	**1.6%**	**62.7%**	**0.3419**
Dickson	3-Central	No	58	1.3%	50.9%	1,710,920	0.9%	63.5%	0.1947
Cumberland	2-Southeast	No	55	1.2%	52.1%	2,251,663	1.2%	64.7%	0.2562
Roane	**1-Northeast**	**Random**	**54**	**1.2%**	**53.3%**	**1,963,034**	**1.0%**	**65.7%**	**0.2233**
Bradley	2-Southeast	No	53	1.2%	54.5%	2,899,281	1.5%	67.2%	0.3299
Henderson	4-West	No	53	1.2%	55.7%	1,592,553	0.8%	68.1%	0.1812
Anderson	1-Northeast	No	52	1.2%	56.9%	2,147,996	1.1%	69.2%	0.2444
Gibson	4-West	No	51	1.1%	58.0%	1,125,789	0.6%	69.7%	0.1281
Williamson	**3-Central**	**Random**	**51**	**1.1%**	**59.1%**	**6,049,807**	**3.1%**	**72.9%**	**0.6883**
Bedford	3-Central	No	50	1.1%	60.3%	1,105,125	0.6%	73.5%	0.1257
Marion	**2-Southeast**	**Random**	**48**	**1.1%**	**61.3%**	**1,882,312**	**1.0%**	**74.4%**	**0.2142**
Cocke	1-Northeast	No	47	1.1%	62.4%	1,233,802	0.6%	75.1%	0.1404
Campbell	1-Northeast	No	46	1.0%	63.4%	1,623,505	0.8%	75.9%	0.1847
Henry	4-West	No	44	1.0%	64.4%	874,993	0.5%	76.4%	0.0995
Tipton	**4-West**	**Random**	**44**	**1.0%**	**65.4%**	**1,093,679**	**0.6%**	**76.9%**	**0.1244**
Monroe	1-Northeast	No	43	1.0%	66.4%	1,332,821	0.7%	77.6%	0.1516
Carter	1-Northeast	No	41	0.9%	67.3%	1,100,328	0.6%	78.2%	0.1252
Claiborne	1-Northeast	No	41	0.9%	68.2%	808,201	0.4%	78.6%	0.0920
Morgan	1-Northeast	No	40	0.9%	69.1%	426,572	0.2%	78.8%	0.0485
Cheatham	3-Central	No	39	0.9%	70.0%	1,256,054	0.7%	79.5%	0.1429
Jefferson	1-Northeast	No	39	0.9%	70.8%	2,462,960	1.3%	80.8%	0.2802
Lawrence	3-Central	No	38	0.9%	71.7%	989,758	0.5%	81.3%	0.1126
Marshall	3-Central	No	38	0.9%	72.5%	925,744	0.5%	81.8%	0.1053
Warren	**2-Southeast**	**Random**	**37**	**0.8%**	**73.4%**	**904,997**	**0.5%**	**82.2%**	**0.1030**
Carroll	4-West	No	36	0.8%	74.2%	752,473	0.4%	82.6%	0.0856
Giles	3-Central	No	36	0.8%	75.0%	1,150,659	0.6%	83.2%	0.1309
Hamblen	1-Northeast	No	36	0.8%	75.8%	1,786,267	0.9%	84.1%	0.2032
Obion	4-West	No	36	0.8%	76.6%	946,898	0.5%	84.6%	0.1077
Franklin	2-Southeast	No	35	0.8%	77.4%	920,950	0.5%	85.1%	0.1048
Fayette	4-West	No	34	0.8%	78.1%	1,494,405	0.8%	85.9%	0.1700
DeKalb	2-Southeast	No	33	0.7%	78.9%	470,214	0.2%	86.1%	0.0535
Lauderdale	4-West	No	32	0.7%	79.6%	561,911	0.3%	86.4%	0.0639
Hickman	3-Central	No	31	0.7%	80.3%	942,821	0.5%	86.9%	0.1073
Loudon	**1-Northeast**	**Random**	**31**	**0.7%**	**81.0%**	**2,185,018**	**1.1%**	**88.0%**	**0.2486**
McNairy	4-West	No	31	0.7%	81.7%	787,695	0.4%	88.4%	0.0896
Dyer	**4-West**	**Random**	**30**	**0.7%**	**82.4%**	**1,191,046**	**0.6%**	**89.1%**	**0.1355**
Overton	2-Southeast	No	29	0.6%	83.0%	582,930	0.3%	89.4%	0.0663
Scott	1-Northeast	No	29	0.6%	83.7%	536,561	0.3%	89.6%	0.0610
Fentress	2-Southeast	No	27	0.6%	84.3%	511,982	0.3%	89.9%	0.0582
Grainger	1-Northeast	No	27	0.6%	84.9%	622,924	0.3%	90.2%	0.0709
Hardin	4-West	No	27	0.6%	85.5%	668,358	0.3%	90.6%	0.0760
Total, 59 Top-85 Counties			3,816	85.5%	85.5%	174,769,143	90.6%	90.6%	

County Selection

From the sampling population, a sample of 16 counties is to be selected. The number of counties (16) in the survey sample is based on the fact that Tennessee has a total of 59 counties in its sampling unit population. Based on recommendations from NHTSA's previous 23 CFR Part 1340 guidelines, 16 is an appropriate number to achieve the desired level of accuracy in belt use estimation. In addition, 16 is the number of counties in the current seat belt use survey design, and it has worked well.

The 16-county sample is chosen using a two-step procedure. First, 4 counties (Shelby, Davidson, Knox, and Hamilton) are placed with certainty into the first tier of the 16 county sample. These counties are the "largest" in the state by several measures. They contain the four largest cities, and each has more population, passenger vehicle occupant fatalities, and DVMT than any other county.

Then, 12 additional counties are selected from the remaining 55 eligible counties to make up the second tier of the survey sample, with probability for selection proportional to the county's DVMT. These counties had their DVMT percentages of the group of 55 ("p") multiplied by 12, the number remaining to be selected. No counties had $12 \times p > 1.0$, so all were eligible for PPS sampling without additional adjustments. The counties were randomly ordered, to eliminate sequential dependencies, and cumulative values of the DVMT percentages×12 were computed.

A random number from a rectangular distribution between 0 and 1.0 was drawn, and 12 counties were selected: the first county whose cumulative DVMT percentage×12 was equal to or greater than the random number, the first whose cumulative DVMT percentage×12 was equal to or greater than the (random number+1), …, and the first whose cumulative DVMT percentage×12 was equal to or greater than the (random number+11). This produced a total sample of 16 counties in two tiers. The four counties in Tier 1 had probability(selection) = 1.0; the remaining counties had probability(selection) = 12 times their DVMT proportion of the DVMT of the final group of 55 counties. These probabilities are shown in Table 1.

A sample of survey counties selected using this procedure is highlighted in Table 1. It is proposed that this sample be used in the 2012 survey, as well as subsequent years of seat belt surveying, which will be conducted upon the approval of this plan.

Road Segment Allocation

Once the 16 survey counties have been chosen, second stage sampling of individual route segments in each of the counties is to be performed. Distribution of segments across counties and road functional class strata is proposed to be done according to the following considerations.

The qualifying route segments comprising the sampling population are identified from the TRIMS road segment file. All route segments define the route segment population for each county. In the sampling, we would omit from consideration rural local road segments in counties not part of Census-defined Metropolitan Statistical Areas (MSAs) as well as road segments identified in the database as frontage roads and segments which are cul-de-sacs or other segment types which may be excluded according to NHTSA guidelines. The numbers of road segments available to the survey are shown in Table 2.

Table 2. Numbers of Road Segments by Functional Class and Sample County[1,2]

	FHWA Roadway Functional Class												
County	1 Rur prin art intst	2 Rur prin art othr	6 Rur minor art	7 Rur major coll	8 Rur minor coll	9 Rur local	11 Urb prin art intst	12 Urb prin art xway	14 Urb prin art othr	16 Urb minor art	17 Urb coll	19 Urb local	Total
Shelby	1	12	12	5	56	696	93	61	294	613	562	8,354	10,759
Davidson	12	7	46	4	34	469	107	57	193	303	206	8,010	9,448
Knox	8	0	12	30	58	785	80	4	152	254	250	8,270	9,903
Hamilton	2	13	3	12	38	487	56	68	176	445	283	6,379	7,962
Subtotal	**23**	**32**	**73**	**51**	**186**	**2,437**	**336**	**190**	**815**	**1,615**	**1,301**	**31,013**	**38,072**
Rutherford	1	14	20	27	61	869	41	10	64	97	166	4,126	5,496
Montgomery	3	4	17	18	64	1,133	17	0	67	109	97	2,194	3,723
Sevier	0	13	18	42	44	*2,463*	4	0	45	21	57	1,165	3,872
McMinn	8	16	25	31	69	*1,152*	2	0	22	45	27	451	1,848
Blount	0	11	10	17	58	840	2	6	49	77	167	2,105	3,342
Roane	10	16	7	31	74	*1,203*	17	0	26	79	71	719	2,253
Williamson	6	12	32	20	72	1,168	23	1	57	53	106	3,030	4,580
Marion	12	20	15	50	38	1,111	0	0	0	0	0	0	1,246
Tipton	0	10	20	21	67	776	0	0	26	31	25	511	1,487
Warren	0	24	17	36	53	*925*	0	0	27	25	26	333	1,466
Loudon	13	16	21	24	77	1,176	6	0	22	41	45	431	1,872
Dyer	10	17	6	42	65	*700*	4	10	12	34	36	447	1,383
Subtotal	**63**	**173**	**208**	**359**	**742**	**13,516**	**116**	**27**	**417**	**612**	**823**	**15,512**	**32,568**
Total	**86**	**205**	**281**	**410**	**928**	**15,953**	**452**	**217**	**1,232**	**2,227**	**2,124**	**46,525**	**70,640**

[1] *Source: State TRIMS road segment database.*

[2] *Figures in gray italics are rural local roads in non-MSA (Metropolitan Statistical Area) counties.*

First, the route segments from each of the survey counties are stratified into the following five grouping using TDOT functional classification data:

1. Interstates and Other Expressways
2. Other Principal Arterials
3. Minor Arterials
4. Collectors
5. Local Roads

The first four road strata are the same as were used in the current survey; Local Roads are added to reflect the new guidelines' requirements. In the sampling, we would omit from consideration rural local road segments in counties not part of Census-defined Metropolitan Statistical Areas (MSAs) as well as road segments identified in the database as frontage roads and segments which are cul-de-sacs or other segment types which may be excluded according to NHTSA guidelines. The results of combining the roadway functional classes into roadway type strata are shown in Table 3. Counts and DVMT values are from TRIMS and refer specifically to road segments that are available for sampling. Rural local roads in non-MSA counties are excluded. TRIMS contains DVMT measures for all roads that are collectors or larger but almost no DVMT values for local roads, hence the "Unknown" values in Table 3.

Table 3. Roadway Functional Strata by County; Road Segments Available to Sample and DVMT [1]

County		Roadway Functional Strata					Total
		Interstate or Freeway	Other Principal Arterials	Minor Arterials	Collectors	Qualified Local Roads	
Shelby	# Segments	155	306	625	623	9,050	10,759
	DVMT	7,360,530	5,736,722	6,036,071	1,702,527	Unknown	20,835,850
Davidson	# Segments	176	200	349	244	8,479	9,448
	DVMT	10,393,677	3,374,800	3,359,449	1,051,086	Unknown	18,179,011
Knox	# Segments	92	152	266	338	9,055	9,903
	DVMT	5,883,950	2,637,280	2,359,046	1,073,558	Unknown	11,953,834
Hamilton	# Segments	126	189	448	333	6,866	7,962
	DVMT	3,829,220	1,958,630	2,283,531	507,599	Unknown	8,578,981
Rutherford	# Segments	52	78	117	254	4,995	5,496
	DVMT	2,528,642	1,722,549	1,323,452	926,994	Unknown	6,501,637
Montgomery	# Segments	20	71	126	179	3,327	3,723
	DVMT	717,197	1,040,909	1,066,825	418,985	Unknown	3,243,916
Sevier	# Segments	4	58	39	143	1,165	1,409
	DVMT	331,565	1,172,858	710,272	536,381	Unknown	2,751,076
McMinn	# Segments	10	38	70	127	451	696
	DVMT	943,044	264,228	380,656	298,343	Unknown	1,886,271
Blount	# Segments	8	60	87	242	2,945	3,342
	DVMT	112,659	1,209,948	545,444	497,473	Unknown	2,365,524
Roane	# Segments	27	42	86	176	719	1,050
	DVMT	819,288	453,236	168,269	296,761	Unknown	1,737,554
Williamson	# Segments	30	69	85	198	4,198	4,580
	DVMT	1,971,422	1,017,981	1,128,269	833,777	Unknown	4,951,449
Marion	# Segments	12	20	15	88	1,111	1,246
	DVMT	1,225,849	205,319	90,692	293,588	Unknown	1,815,448
Tipton	# Segments	0	36	51	113	1,287	1,487
	DVMT	0	429,152	211,429	245,256	Unknown	885,836
Warren	# Segments	0	51	42	115	333	541
	DVMT	0	419,366	192,736	183,286	Unknown	795,388
Loudon	# Segments	19	38	62	146	1,607	1,872
	DVMT	1,159,807	355,867	202,421	305,691	Unknown	2,023,786
Dyer	# Segments	24	29	40	143	447	683
	DVMT	181,311	431,750	140,638	287,530	Unknown	1,041,229
Total	# Segments	755	1,437	2,508	3,462	56,035	64,197
	DVMT	37,458,162	22,430,595	20,199,200	9,458,834	Unknown	89,546,791

[1] *Counts exclude Rural Local Roads in non-MSA counties. DVMT values are tallies of DVMT for segments in TRIMS; DVMT unknown for nearly all Local Road segments in TRIMS.*

In the current approved design, there are 160 belt use observation segments, 16 per county in the "certainty" counties (the same certainty counties as in the proposed design) and 8 per county in the 12 randomly selected counties (six are repeats in the proposed design), spread evenly across four road functional class strata. This has produced quite reliable statewide belt use estimates; for example, in June 2011, Tennessee measured statewide belt use of 87.4 percent with a standard error of 0.5 percent, well below NHTSA's new requirement of a standard error of 2.5 percent or less. The new design will include local roadways, which may have fewer observations and therefore greater contributions to overall error variance, and so we propose a design with nearly 20 percent more observation segments and expect that design to meet the new reliability standard.

Distribution of segments across counties and road functional class strata is proposed to be done according to the following considerations.

First, the four counties in the first, certainty, tier of selection will have three road segments selected in each road class stratum. Most counties in the second, probabilistic, tier have road segments in each road class stratum. For those, allocate two segments in the four strata with more traffic and three in the Local Road stratum, providing the additional segment to give greater reliability to the county-stratum likely to have fewer observations per segment. For the two counties in the probabilistic tier that do not have interstates or other freeways, allocate a third site to Other Principal Arterials, the stratum with the largest DVMT.

The distribution of observation sample segments based on applying this strategy is shown in Table 4. Nearly one-third of the sample segments (60 segments) are allocated to the state's 4 largest counties, 15 each. The 12 smaller counties in the survey will have 10 or 11 segments each, depending on their road type distributions. The result is a design with 190 total road segments.

Table 4. Proposed Segment Sample Size, by Roadway Functional Strata by County.

County	Roadway Functional Strata					Total
	Interstate or Freeway	Other Principal Arterials	Minor Arterials	Collectors	Qualified Local Roads	
Shelby	3	3	3	3	3	15
Davidson	3	3	3	3	3	15
Knox	3	3	3	3	3	15
Hamilton	3	3	3	3	3	15
Rutherford	2	2	2	2	3	11
Montgomery	2	2	2	2	3	11
Sevier	2	2	2	2	3	11
McMinn	2	2	2	2	3	11
Blount	2	2	2	2	3	11
Roane	2	2	2	2	3	11
Williamson	2	2	2	2	3	11
Marion	2	2	2	2	3	11
Tipton	0	3	2	2	3	10
Warren	0	3	2	2	3	10
Loudon	2	2	2	2	3	11
Dyer	2	2	2	2	3	11
TOTAL	32	38	36	36	48	190

Road Segment Selection

Within each county-road type stratum, road segments are chosen with probability proportional to size (PPS). For the four strata with known DVMT, size is represented by segment DVMT. For the Local Road stratum, size is represented by segment length. The target number of segments to be selected is double the number of segments required to be observed.

In order to accomplish this, separately for each county-stratum "pool" of road segments, we use the following steps:

1. Total the DVMT (or length) for the road segments in the county-stratum. For each segment, calculate the percentage its DVMT (length) is of the total.

2. For each segment, multiply its DVMT (length) percentage by "n", the number of road segments to be selected, the required number of sites plus an equal number of alternates.

3. In the case of any segments with a DVMT (length) percentage × $n \geq 1$, identified them as chosen with certainty ($p = 1.0$) and removed them from the pool. Then returned to Step 1, with a reduced number of segments and a reduced number of segments to be selected, $n' = n$ – (number already selected as certainty choices).

4. When there are no longer any segments with a DVMT (length) percentage × n (or n′) ≥ 1, continue to Step 5 to randomly select any segments yet to be selected.

5. Randomly order the segments in the county-stratum to eliminate any sequential dependencies.

6. Compute cumulative percentages from the percentage of the first segment to 100% and multiplied the cumulative percentages by n or n′, the number of road segments yet to be selected.

7. Generated a random number from a rectangular distribution between 0 and 100%.

8. Accepted as observation segments the first segment whose cumulative percentage × n (or n′, in all cases) was equal to or greater than the random number, the first segment whose cumulative DVMT (length) percentage × n was equal to or greater than the (random number+1), … , and the first segment whose cumulative DVMT (length) percentage × n was equal to or greater than the (random number + n-1).

9. For any county-stratum which includes certainty selections, randomly reorder all of the selected segments.

The order of selection is preserved, the segments first selected are the first targets for use, and the remainder are alternates.

This results in 190 segments for observation and 190 segments to be held in reserve as spares. Based on recent Tennessee safety belt surveys using similar observation procedures, this 190-segment sample is expected to return observations for at least 40,000 vehicle occupants.

Segments have been selected according to this procedure. In addition, the direction of travel to be observed has also been selected, randomly as if by a coin flip. The segments for observation are listed in Attachment 2, and the alternate segments are shown in Attachment 3. If one (or more) of the primary segments proves unusable in the field, e.g. due to temporary construction, and picking another observation site on the same segment will not solve the problem, the next alternate segment(s) in order (same county, same road stratum) will be substituted. In subsequent administrations of the survey, observation will resume at the original sites unless they are still unusable, in which case a replacement segment will be selected according to the procedures above. See Attachment 6 for more detail.

Prior to data collection, the state will conduct traffic volume measurements at all of the Local Road segments that have been selected as primary or alternate observation locations. The result will be AADT and DVMT values which can be used in seat belt use calculations.

Observation Site Selection

Prior to the first actual data collection, specific locations for data observations will be selected, based on visits to the locations, maps, and/or on-line road level images. At this time, the direction of travel to be observed will be randomly determined for each segment/site. The

direction chosen will be used unless it requires an unsafe observation location or something such as sun glare makes it extremely difficult to observe seat belt use. In a rare case such as that, the direction to observe will be switched and the reasons documented.

Sites will be selected for observer and traffic safety and such that the observer has a clear view of the vehicles to be coded. Where possible, sites will be selected at controlled intersections or other locations where traffic naturally slows, though our highly trained observers have proven capable of making accurate seat belt use observations for moving traffic. Should specific site locations prove unusable, unsafe, or not allowing clear belt use observations, observers will be able to choose alternate locations within the road segment where they can more effectively observe the same traffic stream.

3. Data Collection

Observers

Observers will be people hired and trained as directed by the state. All will be trained to the specific requirements of Tennessee belt use observation. These observers will perform all field data collection. Prior to any data collection, we will review the procedures with the observers in a training session which includes on-street practice. Training will make use of the detailed observation procedures in Attachment 4 and the data collection and site documentation forms in Attachment 5.

Observers will also be trained on dealing with conditions, such as bad weather or temporary traffic impediments, which can require observation rescheduling and what to do to have sites rescheduled. They will also be trained in how to obtain alternate sites should a primary site be completely unusable during the entire schedule period, which has historically ranged between three and six weeks in length. We estimate that about 6 – 10 observers, who will operate singly, and 1 or 2 quality control monitors will be utilized.

Training will occur shortly before observations are scheduled to begin, but in no case more than one year in advance.

Observation Procedures Overview

An observational segment is a homogeneous segment of roadway, generally ranging in length from 0.5 to 5 miles. A typical segment is approximately 1 mile in length. The longer segments tend to be on major roadways or in rural areas where there are few intersections and/or driveways. As noted above, specific observation sites – places along the segment from which the observer is to make belt use observations – will be tentatively selected prior to any data collection. For the first time observations occur, the observer is allowed to adjust the proposed location, for example, select a position at the first intersection (preferably the first controlled intersection) within the segment.

The observer is to find a safe spot to stand just beyond the edge of the roadway at or very near the intersection, if that is the selected location. The spot must be safe for the observer and traffic, e.g., not distracting to drivers, as well as affording a clear view of the belt use of occupants in approaching vehicles. As part of the first observation visit to the site, the observer will record

any site-specific details, including any need to change location from the preselected site or change the traffic direction to observe.

From the selected vantage point, the observer records the belt use/nonuse of occupants of all passenger vehicles in the travel direction of record. If there are multiple approach lanes in the travel direction of record, the first preference is to record all vehicles in all approach lanes. If traffic is too heavy, then observers will identify a point down the road such that, when they complete recording data for the current vehicle, they can look up and select the next vehicle (in any approach lane) passing the point as the next one for observing.

The observer will record the belt use/nonuse of outboard front seat occupants, drivers and passengers, of qualifying vehicles in the travel direction of record. "Qualifying vehicles" include all passenger cars, pickup trucks, sport utility vehicles (SUVs), and vans, whether private or commercial, with GVWR of 10,000 lbs or less. Other vehicles, such as large buses, larger trucks, and farm equipment, are excluded from observation.

The shoulder belt use/nonuse of all outboard front seat occupants of qualifying vehicles is recorded. Proper placement of the shoulder belt is counted as restrained; nonuse or improper use (e.g., behind the back or under the arm) is counted as unrestrained. "Unknown" is coded if the observer cannot determine belt use. All outboard front seat passengers, regardless of age, are coded except infants in child safety seats; children in booster seats are coded. All qualified outboard front passengers receive code values, even if they are Unknown.

Observation of motorcyclist helmet use will also be coded during the observation period, as long as it does not interfere with the primary task of belt use observation. Since motorcycle traffic volumes are relatively low, all motorcycle traffic visible from the observation site, regardless of direction or lane of travel, is eligible to be counted for the motorcycle helmet use survey. The helmet use/nonuse of both motorcycle drivers and any passengers is recorded.

Scheduling

Observations will be conducted on all days of the week during daylight hours between 7:00 a.m. and 6:00 p.m. Clusters of five or six sites will be scheduled for one observer on any day. The sites in each county will be divided into two or three clusters, with road function strata balanced between clusters, and those clusters will be scheduled for different days of the week, not more than one weekend day per county. The assignment of days of the week will be balanced across similar counties (e.g., urban/rural, part of the state) so that all days of the week have roughly similar numbers of clusters. Within these constraints, actual day of week assignments will be randomly determined.

The first site in any cluster to be observed each day will be randomly selected, and the additional sites will be assigned in an order which provides balance by type of site and time of day while minimizing travel distance and time. For each site, the schedule will specify time of day, day of week, roadway to observe, and direction of traffic to observe.

Depending on the number of sites in a cluster, the time from 7 a.m. to 6 p.m. will be divided into nearly equal-length time periods. For five-site days, time of day will be specified as one of five

time periods, such as 7:00 – 9:00 a.m., 9:00 – 11:00 a.m., 11:00 a.m. – 2:00 p.m., 2:00 – 4:00 p.m., and 4:00 – 6:00 p.m. For six-site days, time of day will be specified as one of six time periods, such as 7 – 8:45 a.m., 8:45 – 10:30 a.m., 10:30 a.m. – 12:15 p.m., 12:15 – 2:30 p.m., 2:30 – 4:15 p.m., and 4:15 – 6:00 p.m. Fewer sites in the cluster will result in more time in each period. Exact timing of the periods will be subject to adjustment so that the result is approximately equal numbers of sites being observed throughout the 7 a.m. – 6 p.m. time frame.

In all cases, the period of actual seat belt use observation will last exactly 45 minutes for Collectors and larger and 75 minutes for Local Roads and will be required to take place within the broader allowable time period. Actual observation time periods will begin at the listed start times, or as close as practical to these times, i.e., as soon the observer can get positioned at the site after the beginning of the period. Observers are instructed to commence counting with the first vehicle which arrives at the site after the time period begins, and to cease counting at the precise end of the 45-minute or 75-minute time period.

All data will be collected within the reporting calendar year. Our preferred approach is to have a data collection schedule extending over approximately four weeks or less, typically in June of the year. Should additional data need to be collected, i.e., for sites with temporary obstacles such as bad weather, for sites that need to be replaced due to roadway or traffic disruptions, to replace invalid data, or to correct problems with total unknowns > 10 percent or a standard error > 2.5 percent, the additional data will be collected during the schedule period or as soon after that as practicable, but in all cases within the same calendar year.

The surveys will continue during mild inclement weather, as long as observations can continue to be recorded with high accuracy and observer safety. In the event of more severe inclement weather, the surveys shall be discontinued until such time as the weather eases. Then, the surveys are resumed according to the original schedule with the next time slot and the appropriate site. Missed observation periods will be rescheduled for the same time period and day of the week in a subsequent week.

If a site cannot be surveyed because of construction activities, safety concerns, or some other (semi-)permanent reason, the first preference is to find another suitable site on the same segment. If the entire segment is unusable, the location is abandoned. The observer is instructed to contact the overall project supervisor to be given an alternate site (same county, same road stratum) and direction for scheduling the observations. Because the total observation time period is about four weeks long, the alternate site can be scheduled for the same time of day and day of week. As noted previously, alternate sites have been selected during the initial sampling process.

In future surveys, we will attempt to return to the originally chosen site. Should the site be permanently unsuitable, a replacement will be chosen by the procedures described above.

For further details of observation procedures, see Attachment 4, procedures, and Attachment 5, data collection forms.

4. Quality Control

Quality control monitors will conduct random, unannounced visits to at least 10 observation sites for the purpose of quality control. The monitor will ensure that the observer is in place and making observations during the observation period. Where possible, the monitor will remain undetected by the observer. It is likely that the person(s) leading the observer training will also serve as quality control monitor(s).

Data Review

Data will be reviewed as received, and anomalies will be investigated to ensure that the data do not reflect anything other than proper on-site seat belt use observations. Some cues to the contrary include repeating patterns within the observation data, unusual proportions of vehicle type, driver or passenger sex, presence of passengers, seat belt use, excessive unknown seat belt use, or very high or low total numbers of observations. Some variation in these values is normal, of course. When suspicious data patterns are noted, we follow up to verify whether observations were done properly or not. Invalid data will be replaced if at all possible, by conducting additional observations at the same site. If the site is unusable, then we will attempt to collect replacement data at another site on the same road segment, or if that is not possible, at a replacement site of the same road stratum in the same county. All additional or replacement data will be collected following the original time of day-day of week schedule.

In our experience, the total percentage of "unknown" belt use observations can be kept at or below 1% through careful training and selection of observation sites. Current Tennessee procedures do not capture "unknown" belt use, but we expect the rate to be comparable to that in other states using procedures similar to those proposed here which will track "unknowns". Similarly, the number of cases where the observer is unable to tell whether there is an outboard front passenger is estimated to be in single digits for the entire survey data collection; this simply does not occur. Should overall "unknown" belt use observations exceed the 10% threshold, we will carefully review observer performance and the quality control results, to see if this signifies a larger problem such as falsifying data. Invalid data, if any, will be discarded. In any case, additional data will be collected until the appropriate "unknown" rate is within acceptable limits. We will begin by repeating data collection at the 20 percent of schedule clusters with the greatest percentage of unknowns, following the original schedule of time of day and day of week. New data will be added to existing valid data.

Should any sites produce no usable data, our first preference will be to obtain usable data through follow-up observations, either at the original sites or different locations on the original segments or, if no sites on the original segments are usable, at substitute segments/sites, consistent with original time of day/day of week scheduling. Should that prove impossible, the sites will be dropped from the calculation formulas. See Attachment 6 for a broader discussion.

Data imputation will not be used.

The results of the survey data collection and coding will be reviewed and approved by the survey statistician before they are submitted to NHTSA.

5. Seat Belt Usage Rate and Variability Calculations

Calculation of Overall Seat Belt Usage Rate

Seat belt use rates will be calculated using formulas based on the proportion of the state's total DVMT "represented" by the site. Seat belt use rate calculations will follow a four-step process.

First, estimated rates will be calculated for each of the five road type strata within each county.

The general formula for combining observed belt use rates from observation sites on individual segments, for a single county-stratum, is shown in formula (1). It is used when the county-stratum contains certainty segments or for Local Road strata, whose segments were selected based on segment length rather than DVMT. Recall that, between the time the Local Road segments were selected and the belt use observations are collected and scored, the state will have measured AADT and thus DVMT for those Local Road segments, so those data are available for use in these formulas.

The contribution of each segment to the overall county-stratum rate is proportional to the "size" of the segment's contribution to the entire county-stratum traffic, i.e., its DVMT, adjusted by the inverse of the probability of the segment's being selected into the sample:

$$p_{i(j)k} = \frac{\sum_{l} DVMT_{i(j)kl} W_{i(j)kl} p_{i(j)kl}}{\sum_{l} DVMT_{i(j)kl} W_{i(j)kl}} \quad (1)$$

where $DVMT_{i(j)kl}$ = DVMT for segment l in county-stratum $i(j)k$; $p_{i(j)kl}$ = the observed seat belt use rate at site $i(j)kl = B_{i(j)kl}/O_{i(j)kl}$, where $B_{i(j)kl}$ = total number of belted occupants (drivers and outboard front-seat passengers) observed at the site and $O_{i(j)kl}$ = total number of occupants with known belt use observed at the site; and $W_{i(j)kl}$ = the inverse of the probability of segment l's selection as described above.

For all except Local Roads:

$$\text{(certainty segments) } W_{i(j)kl} = 1.00 \quad \text{or (random segments) } W_{i(j)kl} = \frac{\sum_{m=1}^{N} DVMT_{i(j)km}}{n * DVMT_{i(j)kl}}$$

where N = total number of segments in county-stratum $i(j)k$ excluding the certainty segments and n = number of segments to be randomly selected.

For Local Roads:

$$\text{(certainty segments) } W_{i(j)kl} = 1.00 \quad \text{or (random segments) } W_{i(j)kl} = \frac{\sum_{m=1}^{N} SegLen_{i(j)km}}{n * SegLen_{i(j)kl}}$$

where N = total number of segments in county-stratum *i(j)k* excluding the certainty segments, and n = number of segments to be randomly selected, and *SegLen* = length of segments in miles.

In the case where there are no certainty segments in the county-stratum, formula 1 reduces to the simple formula 1a for all strata except Local Roads:

$$p_{i(j)k} = \sum_{l=1}^{n_{i(j)k}} p_{i(j)kl} / n_{i(j)k} \qquad (1a)$$

where k = stratum, *i(j)* = county, l = site within stratum and county, $n_{i(j)k}$ = number of sites within the stratum-county, and $p_{i(j)kl}$ = the observed seat belt use rate at site $i(j)kl = B_{i(j)kl}/O_{i(j)kl}$, where $B_{i(j)kl}$ = total number of belted occupants (drivers and outboard front-seat passengers) observed at the site and $O_{i(j)kl}$ = total number of occupants with known belt use observed at the site.

Second, a county-by-county seat belt use rate, $p_{i(j)}$, will be obtained by combining county-stratum seat belt use rates across strata within counties, weighted by the class's relative contribution to total county DVMT:

$$p_{i(j)} = \frac{\sum_k DVMT_{i(j)k}\, p_{i(j)k}}{\sum_k DVMT_{i(j)k}} \qquad (2)$$

where $DVMT_{i(j)k}$ = DVMT of all roads in stratum k in county *i(j)*, and $p_{i(j)k}$ = seat belt use rate for stratum k in county *i(j)*.

In the third step, category-weighted seat belt use rates for each tier of counties will be obtained by combining and weighting the rates from the sampled counties in each tier by their DVMT values and probabilities of being selected:

$$p_j = \frac{\sum_i DVMT_{i(j)} W_{i(j)}\, p_{i(j)}}{\sum_i DVMT_{i(j)} W_{i(j)}} \qquad (3)$$

where $DVMT_{i(j)}$ = total DVMT for county i in tier j and $W_{i(j)}$ = the inverse of the probability of the county's selection: $W_{i(1)} = 1$ for the certainty counties (Tier 1) and $W_{i(2)} = \frac{\sum_{l=1}^{55} DVMT_{l(2)}}{12 * DVMT_{i(2)}}$

where 55 = the number of high-fatality counties in Tier 2 and 12 = the number of those counties selected.

Finally, the statewide belt use proportion will be calculated by combining the category proportions weighted by their proportion of statewide DVMT:

$$p = \frac{\sum_{j=1}^{2} DVMT_j \, p_j}{\sum_{j=1}^{2} DVMT_j} \qquad (4)$$

The result will be a combination of the individual site seat belt use rates weighted to reflect each site's importance in total State DVMT.

Estimates of subgroups of occupants, such as male drivers, female passengers, male drivers of pickup trucks, etc., may be calculated in the same way.

Calculation of the Standard Error of the Overall Seat Belt Use Rate

Standard error of estimate values will be estimated through a jackknife approach, based on the general formula:

$$\hat{\sigma}_{\hat{p}} = [\frac{n-1}{n} \sum_{i=1}^{n} (\hat{p}_i - \hat{p})^2]^{1/2} \qquad (5)$$

where $\hat{\sigma}_{\hat{p}}$ = standard deviation (standard error) of the estimated statewide seat belt use proportion $\hat{p}$ (equivalent to p in the notation of formulas 1-4), n = the number of sites, i.e., 173, and $\hat{p}_i$ = the estimated statewide belt use proportion with site i excluded from the calculation.

The relative error rate, i.e., $\hat{\sigma}_{\hat{p}} / \hat{p}$, will also be calculated, as will the 95% confidence interval, i.e., $\hat{p} \pm 1.96\hat{\sigma}_{\hat{p}}$. These values will be reported for the overall statewide seatbelt use rate.

An Excel spreadsheet will record raw data observations and calculate belt use and standard error. Calculation of seat belt usage rates will follow the formulas provided above. For the statewide belt use figure to be reported to NHTSA, all observations will be included, i.e., all vehicle types, drivers, and outboard front seat passengers. For its own purposes, the state will also be interested in seat belt usage rates for subsets of interest, e.g., drivers alone, passengers alone, drivers and/or passengers within vehicle type, or males or females alone. The same calculations performed for the overall rate can be done for subsets of interest, substituting for the site $p_{i(j)kl}$ the site-subset $p_{i(j)kl}$.

6. Calculation of Overall Seat Belt Usage Rate and Standard Error

Calculation of seat belt usage rates will follow the formulas provided above. An Excel spreadsheet will be used to record the individual vehicle observations and to perform the calculations of the formulas in Section 5 above. The spreadsheet also calculates the jackknife estimate of standard error. SAS has been designated as Tennessee's alternate statistical analysis software in the unlikely event that Excel cannot be used to calculate the standard error of the state's safety belt usage rate.

The state will also be interested in the seat belt usage rates for subsets of interest, e.g., drivers alone, passengers alone, drivers and/or passengers within vehicle type, or males or females alone. The same calculations performed for the overall rate can be done for subsets of interest, substituting for the site $p_{i(j)kl}$ the site-subset $p_{i(j)kl}$. Most of these are also included in the primary spreadsheet.

Statistical Review

The review of the data collection efforts and results, noted above, will continue with a statistical review of the results before any results are reported to NHTSA. The statistical review will confirm that the results meet the criteria for the overall proportion of unknown belt use and standard error and ensure that proper adjustments were made in the case of data being completely absent for any site(s).

Rate of Unknown Belt Use Compliance

As noted above, the oversight of data collection will include monitoring the interim proportions of unknown belt use recorded. It is expected that these proportions should be approximately 1 percent or less, and careful scrutiny will be focused on any results much higher than that. Should it be confirmed that proper observation procedures were used throughout and the overall proportion of belt use unknowns still exceeds the 10 percent criterion, additional data collection would be ordered until the overall proportion dropped to or below 10 percent. We will begin by repeating data collection at the 20 percent of schedule clusters with the greatest percentage of unknowns, following the original schedule of time of day and day of week. New data will be added to existing valid data.

Sites with No Valid Data

Every effort will be made, during the data collection phase, to ensure that no site contributes no useful data. Steps would include rescheduling the original site, finding another site on the original road segment, and substituting a site on another segment in the same county-road stratum, with all data collected according to the original time of day/day of week schedule.

In the extremely unlikely case of a site still having no valid data, calculations will be adjusted accordingly. Data imputation will not be used. In the Formula 1 calculations for the affected county-stratum, the (weighted) average will be based on the remaining site(s). Their weights will not require adjustment, because the relative importance of the remaining sites will be unchanged. Calculations of the other formulas will be unaffected. The same adjustment will be made in the jackknife standard error calculation. See Attachment 6 for a broader discussion.

Standard Error Compliance

In four surveys using the current Tennessee belt use plan with 160 total sites from 2008 through 2011, the observed standard errors of estimate ranged from 0.37 percent to 0.52 percent, well within NHTSA's new requirement of no more than 2.5 percent. The new design, with 190 sites, should also readily meet precision requirements, even though it includes Local Road observation sites which are likely to have relatively few observations per site.

However, should the proposed design yield a standard error in excess of the requirement, additional data would be collected until the criterion is satisfied. Additional data collection would begin with a preselected number of sites having the fewest observations, and new data would be added to existing valid data. If necessary, additional increments of data collection would be undertaken until the required reliability was met. In all cases, additional data for sites would be following the same time of day/day of the week requirements as in the original schedule.

Attachment 1: 36 Counties Excluded from Survey [1,2]

County	Region	Select?	N Fatal	% all TN	Cum %	Total DVMT[1]	% all TN	Cum %
Total, 59 Top-85 Counties			3,816	85.5%	85.5%	174,769,143	90.6%	90.6%
Smith	3-Central	Exclude	27	0.6%	86.1%	978,627	0.5%	91.1%
Haywood	4-West	Exclude	26	0.6%	86.7%	1,294,967	0.7%	91.8%
Humphreys	3-Central	Exclude	26	0.6%	87.2%	878,737	0.5%	92.2%
Lincoln	3-Central	Exclude	25	0.6%	87.8%	875,301	0.5%	92.7%
Union	1-Northeast	Exclude	25	0.6%	88.4%	375,985	0.2%	92.9%
White	2-Southeast	Exclude	25	0.6%	88.9%	675,104	0.3%	93.2%
Chester	4-West	Exclude	23	0.5%	89.4%	402,254	0.2%	93.4%
Benton	4-West	Exclude	22	0.5%	89.9%	692,852	0.4%	93.8%
Grundy	2-Southeast	Exclude	22	0.5%	90.4%	491,953	0.3%	94.0%
Hardeman	4-West	Exclude	22	0.5%	90.9%	684,838	0.4%	94.4%
Polk	2-Southeast	Exclude	22	0.5%	91.4%	521,210	0.3%	94.7%
Macon	3-Central	Exclude	21	0.5%	91.9%	479,854	0.2%	94.9%
Rhea	2-Southeast	Exclude	21	0.5%	92.3%	784,860	0.4%	95.3%
Weakley	4-West	Exclude	20	0.4%	92.8%	792,199	0.4%	95.7%
Sequatchie	2-Southeast	Exclude	19	0.4%	93.2%	387,858	0.2%	95.9%
Stewart	3-Central	Exclude	19	0.4%	93.6%	371,574	0.2%	96.1%
Decatur	4-West	Exclude	18	0.4%	94.0%	523,359	0.3%	96.4%
Johnson	1-Northeast	Exclude	17	0.4%	94.4%	362,554	0.2%	96.6%
Unicoi	1-Northeast	Exclude	15	0.3%	94.8%	652,016	0.3%	96.9%
Crockett	4-West	Exclude	14	0.3%	95.1%	490,491	0.3%	97.2%
Meigs	2-Southeast	Exclude	14	0.3%	95.4%	292,895	0.2%	97.3%
Perry	3-Central	Exclude	14	0.3%	95.7%	213,166	0.1%	97.4%
Wayne	3-Central	Exclude	14	0.3%	96.0%	358,714	0.2%	97.6%
Trousdale	3-Central	Exclude	13	0.3%	96.3%	218,007	0.1%	97.7%
Bledsoe	2-Southeast	Exclude	12	0.3%	96.6%	281,187	0.1%	97.9%
Cannon	2-Southeast	Exclude	12	0.3%	96.8%	323,069	0.2%	98.0%
Clay	2-Southeast	Exclude	12	0.3%	97.1%	184,908	0.1%	98.1%
Jackson	2-Southeast	Exclude	12	0.3%	97.4%	249,233	0.1%	98.3%
Moore	3-Central	Exclude	10	0.2%	97.6%	175,274	0.1%	98.4%
Hancock	1-Northeast	Exclude	9	0.2%	97.8%	102,667	0.1%	98.4%
Houston	3-Central	Exclude	9	0.2%	98.0%	156,622	0.1%	98.5%
Van Buren	2-Southeast	Exclude	9	0.2%	98.2%	182,032	0.1%	98.6%
Lewis	3-Central	Exclude	7	0.2%	98.4%	203,483	0.1%	98.7%
Pickett	2-Southeast	Exclude	7	0.2%	98.5%	134,628	0.1%	98.8%
Lake	4-West	Exclude	3	0.1%	98.6%	94,854	0.0%	98.8%
Coffee	**2-Southeast**	**Exclude**	**63**	**1.4%**	**100.0%**	**2,299,821**	**1.2%**	**100.0%**
Total, 36 Excluded Counties			649	14.5%	100.0%	18,187,153	9.4%	100.0%
Total, Statewide			4,465			192,956,296		

[1] *DVMT from 2010 TN HPMSCntyDVMT.pdf*

Attachment 2: 190 Road Segments for Seat Belt Observations

Segments for Interstates/Expressways, Other Principal Arterials, Minor Arterials, and Collectors[4]

County	FC Strat	Road Name	Route	US Rte Number	Begin Mile	End Mile	Length	AADT	DVMT	FC Num	Incorp. Area Number	Urban Area Number	Prob (Select)	Seln Order	Tier
Blount	1	PELLISSIPPI PKWY.	SR162	--	0.95	2.54	1.59	10950	17410.5	12	5	155	1.0000	1	2
Blount	1	PELLISSIPPI PKWY.	I0140	--	0.83	2.25	1.42	35420	50296.4	11	5	155	1.0000	2	2
Blount	2	AIRPORT HWY.	SR115	129	17.67	18.47	0.8	42010	33608	14	5	155	0.1111	1	2
Blount	2	US-411	SR033	411	0	1.71	1.71	13010	22247.1	2	--	--	0.0735	2	2
Blount	3	OLD KNOXVILLE HWY.	SR033	--	17.44	19.53	2.086	7170	14956.62	16	249	155	0.1097	1	2
Blount	3	MIDDLESETTLEMENTS RD.	1244	--	0	2.7	2.7	1770	4779	16	5	155	0.0350	2	2
Blount	4	PEPPERMINT RD.	5608	--	0	1.1	1.1	3100	3410	17	--	155	0.0274	1	2
Blount	4	OLD NILES FERRY PK.	4816	--	4.36	7.692	3.332	4690	15627.08	17	--	155	0.1257	2	2
Davidson	1	I24	I0024	--	23.73	24.12	0.39	139290	54323.1	11	210	210	0.0314	1	1
Davidson	1	FOUR-FORTY PKWY.	I0440	--	0	1.5	1.5	78270	117405	11	210	210	0.0678	2	1
Davidson	1	ELLINGTON PKWY.	SR006	31E	13.93	14.78	0.85	36250	30812.5	12	210	210	0.0178	3	1
Davidson	2	MURFREESBORO RD.	SR001	41	25.21	26.76	1.55	32270	50018.5	14	210	210	0.0889	1	1
Davidson	2	NOLENSVILLE PK.	SR011	31A	2.03	4.48	2.45	24910	61029.5	14	210	210	0.1085	2	1

[4] FC (road functional class) Stratum: 1 = Interstates/expressways; 2 = Other principal arterials; 3 = Minor arterials; 4 = Collectors.
FC Number: FHWA functional class: 1 = Rural principal arterial interstate; 2 = Rural principal arterial other; 6 = Rural minor arterial; 7 = Rural major collector; 8 = Rural minor collector; 9 = Rural local road; 11 = Urban principal arterial interstate; 12 = Urban principal arterial expressway; 14 = Urban principal arterial other; 16 = Urban minor arterial; 17 = Urban collector; 19 = Urban local road.
Prob (Select) = probability that the segment is selected into either the primary segments (this Attachment) or the secondary segments (Attachment 3).

County	FC Strat	Road Name	Route	US Rte Number	Begin Mile	End Mile	Length	AADT	DVMT	FC Num	Incorp. Area Number	Urban Area Number	Prob (Select)	Seln Order	Tier
Davidson	2	HARDING PL.	SR255	--	0.57	2.77	2.2	33100	72820	14	210	210	0.1295	3	1
Davidson	3	STEWARTS FERRY PK.	3292	--	0	1.82	1.82	12640	23004.8	16	210	210	0.0411	1	1
Davidson	3	ELM HILL PK.	4167	--	3.75	5.75	2	13470	26940	16	210	210	0.0481	2	1
Davidson	3	CHARLOTTE PK.	SR024	70	5.4	6.61	1.21	18210	22034.1	16	210	210	0.0394	3	1
Davidson	4	SAUNDERSVILLE RD.	1006	--	0.72	1.45	0.73	15150	11059.5	17	210	210	0.0631	1	1
Davidson	4	TYNE BLVD.	4880	--	3.202	4.075	0.873	6400	5587.2	17	210	210	0.0319	2	1
Davidson	4	RIVER RD.	4160	--	0	1.45	1.45	3320	4814	8	210	--	0.0275	3	1
Dyer	1	I155	I0155	412	7.4	7.74	0.34	9080	3087.2	1	--	--	0.0681	1	2
Dyer	1	I155	I0155	412	13.25	15.5	2.25	13550	30487.5	11	87	87	0.6726	2	2
Dyer	2	US-51 N.	SR003	51	8.68	9.48	0.8	16350	13080	14	87	87	0.1212	1	2
Dyer	2	US-412	SR020	412	3.34	7.26	3.92	9800	38416	2	--	--	0.3559	2	2
Dyer	3	LAKE RD.	SR078	--	0.13	1.59	1.46	8440	12322.4	16	87	87	0.3505	1	2
Dyer	3	LAKE RD.	SR078	--	2.76	4.95	2.19	6460	14147.4	6	--	--	0.4024	2	2
Dyer	4	PARR AVE.	1433	--	0.89	2.22	1.33	3780	5027.4	8	87	--	0.0699	1	2
Dyer	4	LANES FERRY RD.	826	--	7.23	9.18	1.95	2470	4816.5	8	--	--	0.0670	2	2
Hamilton	1	I-24	I0024	--	11.42	12.08	0.658	106230	69899.34	11	89	52	0.1095	1	1
Hamilton	1	I-24	I0024	--	13.34	13.75	0.406	117770	47814.62	11	52	52	0.0749	2	1
Hamilton	1	I-24	I0024	--	9.351	10.06	0.709	107410	76153.69	11	52	52	0.1193	3	1
Hamilton	2	SILVERDALE HWY.	SR058	--	4.7	6.29	1.59	36340	57780.6	14	52	52	0.1770	1	1
Hamilton	2	BARTON AVE.	3589	--	0	0.18	0.18	12460	2242.8	14	52	52	0.0069	2	1
Hamilton	2	STATE HWY. 111	SR111	--	1.444	4.54	3.096	11190	34644.24	2	--	--	0.1061	3	1
Hamilton	3	ACCESS RD.	3542	--	1.82	2.08	0.26	10950	2847	16	52	52	0.0075	1	1

County	FC Strat	Road Name	Route	US Rte Number	Begin Mile	End Mile	Length	AADT	DVMT	FC Num	Incorp. Area Number	Urban Area Number	Prob (Select)	Seln Order	Tier
Hamilton	3	APISON PK.	SR317	--	9.13	10.3	1.17	18050	21118.5	16	60	52	0.0555	2	1
Hamilton	3	JENKINS RD.	3607	--	0	1.79	1.79	5720	10238.8	16	52	52	0.0269	3	1
Hamilton	4	DELASHMITT RD.	4416	--	0.93	1.457	0.527	2180	1148.86	17	52	52	0.0136	1	1
Hamilton	4	NOAH REID RD.	3602	--	0	1.66	1.66	1350	2241	17	52	52	0.0265	2	1
Hamilton	4	FAIRVIEW RD.	4135	--	4.092	5.723	1.631	2990	4876.69	17	--	52	0.0576	3	1
Knox	1	I-640	I0640	25W	0.9	2.41	1.51	68940	104099.4	11	155	155	0.1062	1	1
Knox	1	I-40	I0040	--	6.11	7.39	1.28	121760	155852.8	11	155	155	0.1589	2	1
Knox	1	I-40	I0040	--	33.3	33.86	0.557	80830	45022.31	1	155	--	0.0459	3	1
Knox	2	KINGSTON PK.	SR001	11	9.07	13.84	4.77	26790	127788.3	14	155	155	0.2907	1	1
Knox	2	OAK RIDGE HWY.	SR062	--	9.73	9.87	0.14	24770	3467.8	14	155	155	0.0079	2	1
Knox	2	MAYNARDVILLE PK.	SR033	--	15.75	18.89	3.14	16050	50397	14	--	155	0.1147	3	1
Knox	3	E. EMORY RD.	SR131	--	16.59	17.05	0.46	23560	10837.6	16	--	155	0.0276	1	1
Knox	3	N. WEISGARBER RD.	5289	--	0.5	1.51	1.01	17720	17897.2	16	155	155	0.0455	2	1
Knox	3	E. EMORY RD.	SR131	--	17.05	19.75	2.7	14840	40068	16	--	155	0.1019	3	1
Knox	4	VOLUNTEER BLVD.	5671	--	0	1.413	1.413	9120	12886.56	17	155	155	0.0720	1	1
Knox	4	GLEASON DR.	4827	--	1.497	3.13	1.633	7750	12655.75	17	155	155	0.0707	2	1
Knox	4	MASCOT PK.	1262	--	3.13	5.55	2.42	6610	15996.2	8	--	--	0.0894	3	1
Loudon	1	I75	I0075	--	6.112	10.18	4.068	47950	195060.6	1	--	--	0.6727	1	2
Loudon	1	I40	I0040	--	0.609	4.86	4.251	38640	164258.6	1	--	--	0.5665	2	2
Loudon	2	US-321	SR073	321	0.21	2.99	2.78	8650	24047	2	165	--	0.2703	1	2
Loudon	2	US HWY. 11	SR002	11	15.2	18.4	3.2	10090	32288	14	--	155	0.3629	2	2
Loudon	3	STATE HWY. 72	SR072	--	13.8	16.97	3.17	1790	5674.3	6	--	--	0.1121	1	2
Loudon	3	EAST LEE HWY.	SR002	11	7.916	9.395	1.479	13440	19877.76	6	--	--	0.3928	2	2
Loudon	4	HICKORY CREEK RD.	1279	--	0	0.477	0.477	940	448.38	17	--	155	0.0059	1	2

County	FC Strat	Road Name	Route	US Rte Number	Begin Mile	End Mile	Length	AADT	DVMT	FC Num	Incorp. Area Number	Urban Area Number	Prob (Select)	Seln Order	Tier
Loudon	4	HWY. 70	SR001	70	0	2.813	2.813	3380	9507.94	7	--	--	0.1244	2	2
Marion	1	I-24	I0024	64	2.06	8.36	6.3	31850	200655	1	--	--	0.6547	1	2
Marion	1	I-24	I0024	64	8.36	16.07	7.713	31890	245967.6	1	--	--	0.8026	2	2
Marion	2	US-HWY. 72	SR027	72	0	1.075	1.075	13370	14372.75	2	--	--	0.2800	1	2
Marion	2	US-HWY. 72	SR027	72	3.913	4.22	0.307	23420	7189.94	2	151	--	0.1401	2	2
Marion	3	GRIFFITH HWY.	SR027	--	17.55	18.5	0.952	4540	4322.08	6	329	--	0.2739	1	2
Marion	3	GRIFFITH HWY.	SR027	--	18.5	28.05	9.548	4540	43347.92	6	--	--	1.0000	2	2
Marion	4	VALLEY VIEW HWY.	1131	--	5.27	6.31	1.04	1810	1882.4	8	--	--	0.0256	1	2
Marion	4	POCKET RD.	2169	--	0	6.98	6.98	640	4467.2	8	--	--	0.0609	2	2
McMinn	1	I-75	I0075	--	7.33	13.55	6.224	36370	226366.9	1	--	--	0.9606	1	2
McMinn	1	I-75	I0075	--	13.82	15.34	1.518	38100	57835.8	11	13	13	0.2454	2	2
McMinn	2	US-HWY. 411	SR033	411	6.752	9.46	2.708	6050	16383.4	2	--	--	0.2480	1	2
McMinn	2	US-HWY. 411	SR033	411	1.434	3.96	2.526	6310	15939.06	2	--	--	0.2413	2	2
McMinn	3	SR-68	SR068	--	5.31	8.104	2.794	6690	18691.86	6	--	--	0.1964	1	2
McMinn	3	US-HWY 11	SR002	11	1.37	7.56	6.19	4570	28288.3	6	--	--	0.2973	2	2
McMinn	4	CR-750	1225	--	0	9.21	9.21	2270	20906.7	8	--	--	0.2803	1	2
McMinn	4	RICEVILLE DECATUR ETOWAH RD.	SR039	11BR	1.66	5.78	4.12	2130	8775.6	7	--	--	0.1177	2	2
Montgomery	1	I-24	I0024	--	6.46	7.96	1.5	39190	58785	11	55	55	0.3279	1	2
Montgomery	1	I-24	I0024	--	4.048	4.41	0.362	38180	13821.16	11	55	55	0.0771	2	2

County	FC Strat	Road Name	Route	US Rte Number	Begin Mile	End Mile	Length	AADT	DVMT	FC Num	Incorp. Area Number	Urban Area Number	Prob (Select)	Seln Order	Tier
Montgomery	2	DOVER RD.	SR076	79	0	5.51	5.51	7580	41765.8	2	--	--	0.1605	1	2
Montgomery	2	WILMA RUDOLPH BLVD.	SR013	79	23.93	24.33	0.4	32740	13096	14	55	55	0.0503	2	2
Montgomery	3	MADISON ST.	SR112	41A	9.58	10.74	1.156	23810	27524.36	16	55	55	0.1032	1	2
Montgomery	3	TRENTON RD.	SR048	--	8.37	11.65	3.28	11780	38638.4	16	55	55	0.1449	2	2
Montgomery	4	TYLERTOWN RD.	1418	--	1.79	3.98	2.19	5750	12592.5	8	--	--	0.1202	1	2
Montgomery	4	WHITFIELD RD.	4763	--	0	1.56	1.56	2570	4009.2	17	55	55	0.0383	2	2
Roane	1	I40	I0040	--	16.71	20.4	3.686	38380	141468.7	1	--	--	0.6907	1	2
Roane	1	I40	I0040	--	15.19	16.24	1.05	44430	46651.5	11	153	153	0.2278	2	2
Roane	2	GALLAHER RD.	SR058	--	13.82	14.86	1.042	9940	10357.48	14	153	153	0.0914	1	2
Roane	2	US-HWY. 27	SR061	27	3.36	5.47	2.11	16570	34962.7	14	126	126	0.3086	2	2
Roane	3	ROANE STATE HWY.	SR001	70	7.478	8.8	1.322	4250	5618.5	16	250	250	0.1336	1	2
Roane	3	PINE RIDGE RD.	SR029	--	4.56	5.14	0.58	9300	5394	16	126	126	0.1282	2	2
Roane	4	GALLAHER RD.	SR326	--	0.977	1.32	0.343	4460	1529.78	17	153	153	0.0206	1	2
Roane	4	GALLAHER RD.	SR326	--	0	0.959	0.959	4460	4277.14	7	--	--	0.0577	2	2
Rutherford	1	I24	I0024	--	4.31	6.73	2.42	104170	252091.4	11	--	210	0.3988	1	2
Rutherford	1	I24	I0024	--	6.818	11.27	4.452	97480	433981	11	--	210	0.6865	2	2
Rutherford	2	STATE HWY. 840 S.	SR840	--	16.03	19.86	3.828	22840	87431.52	2	--	--	0.2030	1	2
Rutherford	2	STATE HWY. 840 S.	SR840	--	0	1.53	1.53	21900	33507	2	--	--	0.0778	2	2
Rutherford	3	ASH ST.	3363	--	1.924	2.03	0.106	1010	107.06	16	209	210	0.0003	1	2
Rutherford	3	HORTON HWY.	SR011	31A	0	2.45	2.45	3860	9457	6	--	--	0.0286	2	2

County	FC Strat	Road Name	Route	US Rte Number	Begin Mile	End Mile	Length	AADT	DVMT	FC Num	Incorp. Area Number	Urban Area Number	Prob (Select)	Seln Order	Tier
Rutherford	4	HALLS HILL PK.	1046	--	2.587	6.435	3.848	1980	7619.04	8	--	--	0.0329	1	2
Rutherford	4	MT HERMAN RD.	1617	--	3.868	6.29	2.422	770	1864.94	8	--	--	0.0080	2	2
Sevier	1	I40	I0040	--	0	1.85	1.85	70420	130277	11	263	263	1.0000	1	2
Sevier	1	I40	I0040	--	2.96	4.76	1.8	68840	123912	11	263	263	1.0000	2	2
Sevier	2	PARKWAY	SR071	321	17.6	20.75	3.149	42040	132384	2	--	--	0.4515	1	2
Sevier	2	PARKWAY	SR071	441	26.89	27.52	0.63	37440	23587.2	14	263	263	0.0804	2	2
Sevier	3	CHAPMAN HWY. / US-411	SR035	411	2.899	4.92	2.021	19580	39571.18	6	--	--	0.2229	1	2
Sevier	3	PITTMAN PKWY	SR073	321	17.39	22.83	5.438	5960	32410.48	6	326	--	0.1825	2	2
Sevier	4	BIRD CREEK RD.	SR454	--	3.942	6.39	2.448	5840	14296.32	7	--	--	0.1066	1	2
Sevier	4	APPLE VALLEY RD.	4694	--	0	1.343	1.343	4120	5533.16	17	263	263	0.0413	2	2
Shelby	1	I-240	I0240	--	13.31	15.57	2.26	149320	337463.2	11	191	191	0.2751	1	1
Shelby	1	I-240	I0240	--	11.06	12.43	1.37	156970	215048.9	11	191	191	0.1753	2	1
Shelby	1	I-240	I0240	--	17.6	18.88	1.28	194040	248371.2	11	191	191	0.2025	3	1
Shelby	2	GERMANTOWN RD.	SR177	--	6.04	7.32	1.28	59980	76774.4	14	--	191	0.0803	1	1
Shelby	2	LAMAR AVE.	SR004	78	2.09	3.74	1.65	39410	65026.5	14	191	191	0.0680	2	1
Shelby	2	COVINGTON PK.	SR204	--	3.72	4.29	0.57	21460	12232.2	14	191	191	0.0128	3	1
Shelby	3	WOLF RIVER BLVD.	5426	--	0	3.79	3.79	11280	42751.2	16	61	191	0.0425	1	1
Shelby	3	KNIGHT ARNOLD RD.	5012	--	1.17	6.64	5.47	17130	93701.1	16	191	191	0.0931	2	1
Shelby	3	RAINES RD.	4189	--	1.09	5.08	3.99	13040	52029.6	16	191	191	0.0517	3	1
Shelby	4	N. EVERGREEN ST.	5224	--	1.24	3.24	2	4840	9680	17	191	191	0.0341	1	1
Shelby	4	HODGE RD.	5081	--	0	1.33	1.33	4160	5532.8	17	191	191	0.0195	2	1
Shelby	4	GERMANTOWN RD.	5024	--	2.04	3.22	1.18	13880	16378.4	17	191	191	0.0577	3	1

County	FC Strat	Road Name	Route	US Rte Number	Begin Mile	End Mile	Length	AADT	DVMT	FC Num	Incorp. Area Number	Urban Area Number	Prob (Select)	Seln Order	Tier
Tipton	2	US-HWY. 51 S.	SR003	51	5.06	7.39	2.33	17400	40542	14	14	14	0.5668	1	2
Tipton	2	US-HWY. 51 S.	SR003	51	8.42	9.83	1.41	17400	24534	2	33	--	0.3430	2	2
Tipton	2	HWY. 51 S.	SR003	51	14.6	16.65	2.05	22520	46166	14	68	68	0.6454	3	2
Tipton	3	W. LIBERTY ST.	SR059	--	17.89	18.7	0.81	4050	3280.5	16	68	68	0.0621	1	2
Tipton	3	HWY. 59 S.	SR059	--	25.42	28.69	3.27	3880	12687.6	6	--	--	0.2400	2	2
Tipton	4	MT. CARMEL RD.	SR384	--	0	3.58	3.58	2760	9880.8	7	--	--	0.1612	1	2
Tipton	4	ATOKA-IDAVILLE RD.	SR206	--	3.28	7.64	4.36	3680	16044.8	7	--	--	0.2617	2	2
Warren	2	MANCHESTER HWY.	SR055	--	8.421	9.13	0.709	14660	10393.94	14	181	181	0.1487	1	2
Warren	2	SPARTA HWY.	SR001	70S	16.97	17.83	0.86	12280	10560.8	2	--	--	0.1511	2	2
Warren	2	MANCHESTER HWY.	SR055	--	9.13	9.175	0.045	10400	468	14	181	181	0.0067	3	2
Warren	3	NEW SMITHVILLE HWY.	SR056	--	17.99	23.44	5.448	5370	29255.76	6	--	--	0.6072	1	2
Warren	3	HARRISON FERRY RD.	SR008	--	5.386	11.26	5.874	2160	12687.84	6	--	--	0.2633	2	2
Warren	4	OLD ROCK ISLAND RD.	SR288	--	0	1.331	1.331	3120	4152.72	7	--	--	0.0906	1	2
Warren	4	W. GREEN HILL RD.	SR287	--	21.92	27.83	5.91	1220	7210.2	7	--	--	0.1574	2	2
Williamson	1	I65	I0065	--	18.53	21.38	2.85	135430	385975.5	11	32	210	0.7831	1	2
Williamson	1	I65	I0065	--	8.77	10.99	2.22	69320	153890.4	11	103	210	0.3122	2	2
Williamson	2	MACK HATCHER MEMORIAL PKW	SR397	--	0	1.82	1.82	18970	34525.4	14	103	210	0.1357	1	2

County	FC Strat	Road Name	Route	US Rte Number	Begin Mile	End Mile	Length	AADT	DVMT	FC Num	Incorp. Area Number	Urban Area Number	Prob (Select)	Seln Order	Tier
Williamson	2	MACK HATCHER MEMORIAL PKW	SR397	--	4.06	5.7	1.64	20550	33702	14	103	210	0.1324	2	2
Williamson	3	HILLSBORO RD.	SR106	431	22.7	23.35	0.652	15330	9995.16	6	--	--	0.0354	1	2
Williamson	3	FRANKLIN RD.	SR006	31	12.88	14.09	1.214	14740	17894.36	16	103	210	0.0634	2	2
Williamson	4	S. CAROTHERS RD.	4745	--	0.45	1.15	0.7	6170	4319	17	103	210	0.0207	1	2
Williamson	4	CLOVERCROFT RD.	984	--	0.041	5.651	5.61	3300	18513	8	--	--	0.0888	2	2

Segments for Local Roads[5]

County	Co – RF Stratum	Road Name	Route	Begin Mile	End Mile	Length	Func. Class	Incorp. Area Number	Urban Area Number	Stratum Length	Prob (Select)	Seln Order	Tier
Blount	55	ALCOA TR.	0B969	0.000	0.632	0.632	U / LOCAL	5	155	1,008.61	0.0063	1	2
Blount	55	PARKVIEW DR.	0A348	0.000	0.230	0.230	U / LOCAL	--	155	1,008.61	0.0023	2	2
Blount	55	CHEROKEE INDIAN CIR.	0A474	0.000	0.428	0.428	R / LOCAL	--	--	1,008.61	0.0042	3	2
Davidson	195	MEMORIAL DR.	0A325	0.000	0.291	0.291	U / LOCAL	117	210	2,278.53	0.0013	1	1
Davidson	195	SAMOA DR.	0A885	0.000	0.334	0.334	U / LOCAL	210	210	2,278.53	0.0015	2	1
Davidson	195	OLD MCGAVOCK PK.	0B564	0.000	0.249	0.249	U / LOCAL	210	210	2,278.53	0.0011	3	1
Dyer	235	CLIFTON DR	0A497	0.000	0.500	0.500	U / LOCAL	87	87	89.47	0.0559	1	2
Dyer	235	E MCGAUGHEY ST	0A113	0.000	0.140	0.140	U / LOCAL	87	87	89.47	0.0156	2	2

[5] Co-RF Stratum = County number (5 – 94) + 5 = Local road stratum; Stratum Length = total mileage in county-stratum
Prob (Select) = probability that the segment is selected into either the primary segments (this Attachment) or the secondary segments (Attachment 3).

County	Co – RF Stratum	Road Name	Route	Begin Mile	End Mile	Length	Func. Class	Incorp. Area Number	Urban Area Number	Stratum Length	Prob (Select)	Seln Order	Tier
Dyer	235	LINDEN RD	0A530	0.000	0.260	0.260	U / LOCAL	87	87	89.47	0.0291	3	2
Hamilton	335	EASTGATE LOOP	0C359	0.000	1.041	1.041	U / LOCAL	52	52	1,870.93	0.0056	1	1
Hamilton	335	HANSLEY DR.	0D254	0.000	0.594	0.594	U / LOCAL	52	52	1,870.93	0.0032	2	1
Hamilton	335	MEADOW LN.	0B697	0.000	0.259	0.259	U / LOCAL	52	52	1,870.93	0.0014	3	1
Knox	475	HUCKLEBERRY SPRINGS RD.	0A036	0.490	2.603	2.113	R / LOCAL	--	--	2,470.04	0.0086	1	1
Knox	475	JIM WOLFE RD.	0D367	0.000	2.203	2.203	R / LOCAL	--	--	2,470.04	0.0089	2	1
Knox	475	KERN RD.	0E524	0.000	0.411	0.411	U / LOCAL	--	155	2,470.04	0.0017	3	1
Loudon	535	ELOKWA WAY	0B085	0.453	1.079	0.626	R / LOCAL	--	--	562.71	0.0111	1	2
Loudon	535	FRIENDSVILLE RD.	0A375	0.000	1.695	1.695	R / LOCAL	--	--	562.71	0.0301	2	2
Loudon	535	BONA VISTA LN.	0A740	0.000	0.133	0.133	U / LOCAL	--	155	562.71	0.0024	3	2
Marion	585	BAKER LN.	0A068	0.000	1.464	1.464	R / LOCAL	--	--	439.44	0.0333	1	2
Marion	585	EGYPT HOLLOW RD.	0A262	0.000	0.933	0.933	R / LOCAL	--	--	439.44	0.0212	2	2
Marion	585	KETNER MILL LN.	0A164	0.000	1.408	1.408	R / LOCAL	--	--	439.44	0.0320	3	2
McMinn	545	SHRYER RD.	0A906	0.000	0.350	0.350	U / LOCAL	13	13	95.36	0.0367	1	2
McMinn	545	FRANCIS ST.	0A868	0.000	0.297	0.297	U / LOCAL	13	13	95.36	0.0311	2	2
McMinn	545	SPRINGFIELD DR.	0A843	0.149	0.306	0.157	U / LOCAL	13	13	95.36	0.0165	3	2
Montgomery	635	ADDISON DR.	0C307	0.000	0.357	0.357	U / LOCAL	55	55	1,311.55	0.0027	1	2
Montgomery	635	CARDINAL LN.	0A215	0.000	1.021	1.021	U / LOCAL	55	55	1,311.55	0.0078	2	2
Montgomery	635	CROCKARELL RD.	0A258	0.000	1.012	1.012	R / LOCAL	--	--	1,311.55	0.0077	3	2
Roane	735	AHLER RD.	0A449	0.000	0.590	0.590	U / LOCAL	126	126	170.47	0.0346	1	2
Roane	735	HOBSON RD.	0A609	0.027	1.026	0.999	U / LOCAL	--	153	170.47	0.0586	2	2
Roane	735	RAINTREE LN.	0B313	0.000	0.078	0.078	U / LOCAL	153	153	170.47	0.0046	3	2
Rutherford	755	WELLINGTON PL.	0B508	0.000	1.487	1.487	U / LOCAL	209	210	1,497.31	0.0099	1	2

County	Co – RF Stratum	Road Name	Route	Begin Mile	End Mile	Length	Func. Class	Incorp. Area Number	Urban Area Number	Stratum Length	Prob (Select)	Seln Order	Tier
Rutherford	755	REGENCY PARK DR.	0B636	0.000	1.456	1.456	U / LOCAL	209	210	1,497.31	0.0097	2	2
Rutherford	755	JOE BROWN RD.	0A269	0.000	1.520	1.520	R / LOCAL	--	--	1,497.31	0.0102	3	2
Sevier	785	RAIL ROAD ST.	0B072	0.287	0.679	0.392	U / LOCAL	263	263	255.22	0.0154	1	2
Sevier	785	S. RIVER RD.	0A978	0.000	1.385	1.385	U / LOCAL	234	234	255.22	0.0543	2	2
Sevier	785	PICKEL ST.	0A995	0.000	0.344	0.344	U / LOCAL	234	234	255.22	0.0135	3	2
Shelby	795	EGYPT-CENTRAL RD	0D017	0.110	2.430	2.320	U / LOCAL	191	191	2,351.00	0.0099	1	1
Shelby	795	ROBIN HOOD LN	0B511	0.000	1.020	1.020	U / LOCAL	191	191	2,351.00	0.0043	2	1
Shelby	795	STACEY ST	0K186	0.000	0.450	0.450	U / LOCAL	191	191	2,351.00	0.0019	3	1
Tipton	845	CHISOLM TR.	0A667	0.000	0.330	0.330	R / LOCAL	--	--	660.91	0.0050	1	2
Tipton	845	FANNIE DR.	0A425	0.000	0.420	0.420	R / LOCAL	--	--	660.91	0.0064	2	2
Tipton	845	ATOKA MCLAUGHLIN DR.	0B039	0.000	0.440	0.440	U / LOCAL	14	14	660.91	0.0067	3	2
Warren	895	BYBEE BRANCH RD.	0A015	0.975	1.861	0.886	U / LOCAL	181	181	75.80	0.1169	1	2
Warren	895	SHADOWLAWN ST.	0A668	0.000	0.326	0.326	U / LOCAL	181	181	75.80	0.0430	2	2
Warren	895	CADILLAC LN.	0A913	0.000	0.884	0.884	U / LOCAL	181	181	75.80	0.1166	3	2
Williamson	945	MILEBROOK RD.	0A651	0.000	0.660	0.660	U / LOCAL	32	210	1,259.13	0.0052	1	2
Williamson	945	BOSK LN.	0D397	0.000	0.396	0.396	R / LOCAL	--	--	1,259.13	0.0031	2	2
Williamson	945	CUMBERLAND DR.	0A211	3.973	5.199	1.226	U / LOCAL	99	99	1,259.13	0.0097	3	2

Attachment 3: 190 Spare Road Segments for Seat Belt Observations

Segments for Interstates/Expressways, Other Principal Arterials, Minor Arterials, and Collectors[6]

County	FC Strat	Road Name	Route	US Rte Number	Begin Mile	End Mile	Length	AADT	DVMT	FC Num	Incorp. Area Number	Urban Area Number	Prob (Select)	Seln Order	Tier
Blount	1	PELLISSIPPI PKWY.	I0140	--	0.000	0.830	0.830	41580	34,511.4	11	5	155	1.0000	3	2
Blount	1	PELLISSIPPI PKWY.	SR162	--	0.630	0.950	0.320	10990	3,516.8	12	5	155	0.3368	4	2
Blount	2	SEVIERVILLE RD.	SR035	411	4.670	5.400	0.730	8160	5,956.8	14	185	155	0.0197	3	2
Blount	2	WEARS VALLEY RD.	SR073	321	30.240	33.710	3.470	7350	25,504.5	2	--	--	0.0843	4	2
Blount	3	TOPSIDE RD.	SR333	--	9.030	11.747	2.717	10250	27,849.3	16	342	155	0.2042	3	2
Blount	3	OLD GLORY RD.	SR335	--	3.861	4.971	1.110	7410	8,225.1	16	--	155	0.0603	4	2
Blount	4	N. WRIGHT RD.	3819	--	1.730	2.770	1.040	4680	4,867.2	17	5	155	0.0391	3	2
Blount	4	WILKINSON PK.	3799	--	1.268	2.240	0.972	5680	5,521.0	17	185	155	0.0444	4	2
Davidson	1	BRILEY PKWY.	SR155	--	18.110	18.470	0.360	35180	12,664.8	12	210	210	0.0073	4	1
Davidson	1	I-40	I0040	--	11.400	12.460	1.060	86170	91,340.2	11	210	210	0.0527	5	1
Davidson	1	I24	I0024	--	17.200	18.390	1.190	137530	163,660.7	11	210	210	0.0945	6	1
Davidson	2	BELL RD.	SR254	--	13.967	14.840	0.873	37520	32,755.0	14	210	210	0.0582	4	1

[6] FC (road functional class) Stratum: 1 = Interstates/expressways; 2 = Other principal arterials; 3 = Minor arterials; 4 = Collectors.
FC Number: FHWA functional class: 1 = Rural principal arterial interstate; 2 = Rural principal arterial other; 6 = Rural minor arterial; 7 = Rural major collector; 8 = Rural minor collector; 9 = Rural local road; 11 = Urban principal arterial interstate; 12 = Urban principal arterial expressway; 14 = Urban principal arterial other; 16 = Urban minor arterial; 17 = Urban collector; 19 = Urban local road.
Prob (Select) = probability that the segment is selected into either the primary segments (Attachment 2) or the secondary segments (this Attachment).

County	FC Strat	Road Name	Route	US Rte Number	Begin Mile	End Mile	Length	AADT	DVMT	FC Num	Incorp. Area Number	Urban Area Number	Prob (Select)	Seln Order	Tier
Davidson	2	MURFREESBORO RD.	SR001	41	23.050	24.800	1.750	29100	50,925.0	14	210	210	0.0905	5	1
Davidson	2	MEMPHIS-BRISTOL HWY.	SR001	70S	6.150	7.410	1.260	19820	24,973.2	14	210	210	0.0444	6	1
Davidson	3	WHITE BRIDGE RD.	SR155	--	27.550	29.720	2.170	32450	70,416.5	16	210	210	0.1258	4	1
Davidson	3	ASHLAND CITY HWY.	SR012	--	6.510	10.845	4.335	10410	45,127.4	6	210	--	0.0806	5	1
Davidson	3	FESSLERS LN.	3269	--	0.500	0.810	0.310	22170	6,872.7	16	210	210	0.0123	6	1
Davidson	4	SAWYER BROWN RD.	4897	--	1.340	3.711	2.371	3590	8,511.9	17	210	210	0.0486	4	1
Davidson	4	THOMPSON LN.	4946	--	0.630	2.270	1.640	10960	17,974.4	17	210	210	0.1026	5	1
Davidson	4	HICKS RD.	4896	--	0.380	2.460	2.080	2140	4,451.2	17	210	210	0.0254	6	1
Dyer	1	I155	I0155	412	2.286	7.400	5.114	8730	44,645.2	1	--	--	0.9849	3	2
Dyer	1	I155	I0155	412	1.440	2.280	0.840	9010	7,568.4	1	--	--	0.1670	4	2
Dyer	2	LAKE RD.	SR078	--	1.590	2.330	0.740	23600	17,464.0	14	87	87	0.1618	3	2
Dyer	2	US-51	SR003	51	16.820	17.530	0.710	13680	9,712.8	2	211	--	0.0900	4	2
Dyer	3	HWY. 211	SR211	--	4.510	5.220	0.710	7840	5,566.4	16	--	87	0.1583	3	2
Dyer	3	N. SAMPSON AVE.	2912	--	0.260	0.550	0.290	3580	1,038.2	16	87	87	0.0295	4	2
Dyer	4	STATE HWY. 104	SR104	--	11.370	14.540	3.170	5620	17,815.4	7	--	--	0.2478	3	2
Dyer	4	STATE HWY. 104	SR104	--	0.000	2.530	2.530	400	1,012.0	7	--	--	0.0141	4	2
Hamilton	1	DUPONT PKWY.	SR319	--	2.160	2.870	0.710	27850	19,773.5	12	52	52	0.0310	4	1
Hamilton	1	I-24	I0024	--	4.430	6.750	2.320	74100	171,912.0	11	52	52	0.2694	5	1

County	FC Strat	Road Name	Route	US Rte Number	Begin Mile	End Mile	Length	AADT	DVMT	FC Num	Incorp. Area Number	Urban Area Number	Prob (Select)	Seln Order	Tier
Hamilton	1	I-75	I0075	74	1.970	3.150	1.180	115820	136,667.6	11	52	52	0.2141	6	1
Hamilton	2	SUCK CREEK RD.	SR027	--	1.967	4.000	2.033	5150	10,470.0	14	52	52	0.0321	4	1
Hamilton	2	BROAD ST.	SR002	11	6.210	7.410	1.200	24130	28,956.0	14	52	52	0.0887	5	1
Hamilton	2	HIXSON PK.	SR319	--	6.200	6.360	0.160	28460	4,553.6	14	52	52	0.0139	6	1
Hamilton	3	BOY SCOUT RD.	4470	--	0.000	0.754	0.754	4370	3,295.0	16	52	52	0.0087	4	1
Hamilton	3	E. MAIN ST.	SR008	41	7.792	8.090	0.298	9780	2,914.4	16	52	52	0.0077	5	1
Hamilton	3	DAYTON BLVD.	1406	--	0.000	0.950	0.950	17050	16,197.5	16	241	52	0.0426	6	1
Hamilton	4	BROWNS FERRY RD.	3622	--	0.510	1.490	0.980	8400	8,232.0	17	52	52	0.0973	4	1
Hamilton	4	S. CREST RD.	4984	--	0.000	3.038	3.038	790	2,400.0	17	52	52	0.0284	5	1
Hamilton	4	WEBB RD.	3597	--	0.610	2.126	1.516	3030	4,593.5	17	52	52	0.0543	6	1
Knox	1	I-40	I0040	--	0.000	0.190	0.190	105030	19,955.7	11	--	155	0.0203	4	1
Knox	1	I-75	I0075	--	6.370	6.940	0.570	57900	33,003.0	11	155	155	0.0337	5	1
Knox	1	I-40	I0040	--	11.880	14.180	2.300	172200	396,060.0	11	155	155	0.4039	6	1
Knox	2	PROPOSED	71	--	0.000	2.900	2.900	8120	23,548.0	14	155	155	0.0536	4	1
Knox	2	RUTLEDGE PK.	SR001	11W	28.988	30.290	1.302	12620	16,431.2	14	--	155	0.0374	5	1
Knox	2	WESTERN AVE.	SR062	--	11.050	12.966	1.916	24770	47,459.3	14	155	155	0.1080	6	1
Knox	3	N. CENTRAL ST.	5657	--	0.000	0.550	0.550	3430	1,886.5	16	155	155	0.0048	4	1
Knox	3	PARKSIDE DR.	5615	--	2.182	3.583	1.401	14390	20,160.4	16	155	155	0.0513	5	1
Knox	3	HARDIN VALLEY DR.	1277	--	4.810	8.800	3.990	10490	41,855.1	16	--	155	0.1065	6	1
Knox	4	HOLLYWOOD RD.	5668	--	0.000	0.740	0.740	7030	5,202.2	17	155	155	0.0291	4	1
Knox	4	HELSKELL RD.	1256	--	8.871	10.080	1.209	7170	8,668.5	8	--	--	0.0484	5	1
Knox	4	SEVIERVILLE PK.	5664	--	0.000	2.530	2.530	2450	6,198.5	17	155	155	0.0346	6	1

County	FC Strat	Road Name	Route	US Rte Number	Begin Mile	End Mile	Length	AADT	DVMT	FC Num	Incorp. Area Number	Urban Area Number	Prob (Select)	Seln Order	Tier
Loudon	1	I75	I0075	--	15.206	18.380	3.174	57720	183,203.3	1	--	--	0.6318	3	2
Loudon	1	I75	I0075	--	10.180	13.656	3.476	51140	177,762.6	1	--	--	0.6131	4	2
Loudon	2	EAST LEE HWY.	SR002	11	11.510	12.470	0.960	10820	10,387.2	14	165	155	0.1168	3	2
Loudon	2	US-321	SR073	321	8.421	9.035	0.614	17310	10,628.3	2	--	--	0.1195	4	2
Loudon	3	MULBERRY ST.	SR002	11	3.109	4.650	1.541	5110	7,874.5	6	174	--	0.1556	3	2
Loudon	3	STATE HWY. 72	SR072	--	8.595	10.730	2.135	10890	23,250.2	6	174	--	0.4594	4	2
Loudon	4	HWY. 70	SR001	70	3.172	6.755	3.583	4050	14,511.2	7	--	--	0.1899	3	2
Loudon	4	MAPLE ST.	SR095	--	0.890	1.970	1.080	2930	3,164.4	7	121	--	0.0414	4	2
Marion	1	I-24	I0024	--	21.354	24.170	2.816	44610	125,621.8	1	--	--	0.4099	3	2
Marion	1	I-24	I0024	64	0.010	1.380	1.370	31180	42,716.6	1	199	--	0.1394	4	2
Marion	2	STATE HWY. 28	SR028	--	6.150	9.952	3.802	6310	23,990.6	2	--	--	0.4674	3	2
Marion	2	US-HWY. 72	SR027	72	1.075	2.955	1.880	13370	25,135.6	2	276	--	0.4897	4	2
Marion	3	STATE HWY. 108	SR108	--	1.759	5.800	4.041	2040	8,243.6	6	--	--	0.5224	3	2
Marion	3	MAIN ST. W.	SR002	41	0.037	0.395	0.358	7950	2,846.1	6	199	--	0.1803	4	2
Marion	4	US-HWY. 41	SR002	41	32.660	33.920	1.260	4400	5,544.0	7	--	--	0.0755	3	2
Marion	4	GRIFFITH HWY.	SR027	--	13.630	15.601	1.971	990	1,951.3	7	--	--	0.0266	4	2
McMinn	1	I-75	I0075	--	1.110	7.330	6.220	37960	236,111.2	1	--	--	1.0000	3	2
McMinn	1	I-75	I0075	--	17.190	21.140	3.950	38470	151,956.5	1	--	--	0.6449	4	2
McMinn	2	DECATUR PK.	SR030	--	6.680	8.500	1.820	18440	33,560.8	14	13	13	0.5081	3	2
McMinn	2	N. AMHURST PL.	SR033	411	6.460	6.752	0.292	6050	1,766.6	2	93	--	0.0267	4	2

County	FC Strat	Road Name	Route	US Rte Number	Begin Mile	End Mile	Length	AADT	DVMT	FC Num	Incorp. Area Number	Urban Area Number	Prob (Select)	Seln Order	Tier
McMinn	3	US-HWY 11	SR002	11	20.222	24.420	4.198	4510	18,933.0	6	--	--	0.1990	3	2
McMinn	3	SR-30	SR030	--	0.000	6.200	6.200	9420	58,404.0	6	--	--	0.6137	4	2
McMinn	4	SLACK RD.	4273	--	0.000	0.379	0.379	870	329.7	17	13	13	0.0044	3	2
McMinn	4	ETOWAH RD.	SR163	--	5.110	9.210	4.100	3770	15,457.0	7	--	--	0.2072	4	2
Montgomery	1	I-24	I0024	--	12.800	15.030	2.230	44840	99,993.2	1	--	--	0.5577	3	2
Montgomery	1	I-24	I0024	--	15.030	17.200	2.170	44840	97,302.8	1	--	--	0.5427	4	2
Montgomery	2	RIVERSIDE DR.	SR012	41A	13.060	14.441	1.381	32070	44,288.7	14	55	55	0.1702	3	2
Montgomery	2	FT. CAMPBELL BLVD.	SR012	41A	19.754	21.842	2.088	34750	72,558.0	14	55	55	0.2788	4	2
Montgomery	3	DOVER RD.	SR076	79	11.037	11.250	0.213	16350	3,482.5	16	55	55	0.0131	3	2
Montgomery	3	TRENTON RD.	SR048	--	7.890	8.250	0.360	11780	4,240.8	16	55	55	0.0159	4	2
Montgomery	4	MEMORIAL DR.	3120	--	2.200	3.220	1.020	5960	6,079.2	17	55	55	0.0580	3	2
Montgomery	4	NASHVILLE HWY.	SR112	41A	3.470	7.530	4.060	8870	36,012.2	7	--	--	0.3438	4	2
Roane	1	I40	I0040	--	11.321	12.360	1.039	41680	43,305.5	11	153	153	0.2114	3	2
Roane	1	I40	I0040	--	12.360	15.190	2.830	43600	123,388.0	11	153	153	0.6024	4	2
Roane	2	WHIPP RD.	SR095	--	4.005	5.790	1.785	6870	12,263.0	14	221	221	0.1082	3	2
Roane	2	S. ROANE ST.	SR061	27	5.470	7.030	1.560	13910	21,699.6	14	126	126	0.1915	4	2
Roane	3	STATE HWY-58	SR058	--	0.000	7.080	7.080	2700	19,116.0	6	--	--	0.4544	3	2
Roane	3	STATE HWY-58	SR058	--	7.080	9.360	2.280	4540	10,351.2	6	--	--	0.2461	4	2
Roane	4	US-70	SR001	70	14.060	14.902	0.842	12530	10,550.3	7	126	--	0.1422	3	2
Roane	4	SUGAR GROVE VALLEY RD.	2374	--	1.350	3.660	2.310	2760	6,375.6	8	--	--	0.0859	4	2

County	FC Strat	Road Name	Route	US Rte Number	Begin Mile	End Mile	Length	AADT	DVMT	FC Num	Incorp. Area Number	Urban Area Number	Prob (Select)	Seln Order	Tier
Rutherford	1	I24	I0024	--	27.302	33.290	5.988	37300	223,352.4	1	--	--	0.3533	3	2
Rutherford	1	I24	I0024	--	1.240	2.420	1.180	120020	141,623.6	11	159	210	0.2240	4	2
Rutherford	2	JOHN BRAGG HWY.	SR001	70S	20.082	25.727	5.645	12570	70,957.7	2	--	--	0.1648	3	2
Rutherford	2	MERCURY BLVD.	SR001	70S	17.640	18.320	0.680	15280	10,390.4	14	209	210	0.0241	4	2
Rutherford	3	S. MAIN ST.	SR016	41A	3.460	4.458	0.998	4180	4,171.6	6	88	--	0.0126	3	2
Rutherford	3	S RUTHERFORD BLVD.	1403	--	2.530	4.150	1.620	31410	50,884.2	16	209	210	0.1538	4	2
Rutherford	4	W. JEFFERSON PK	SR266	--	6.332	8.710	2.378	12660	30,105.5	7	--	--	0.1299	3	2
Rutherford	4	MIDLAND-FOSTERVILLE RD.	1047	--	0.000	3.490	3.490	940	3,280.6	8	--	--	0.0142	4	2
Sevier	1	I40	I0040	--	1.850	2.460	0.610	70420	42,956.2	11	263	263	1.0000	3	2
Sevier	1	I40	I0040	--	2.460	2.960	0.500	68840	34,420.0	11	263	263	1.0000	4	2
Sevier	2	W. MAIN ST.	SR035	411	13.740	14.040	0.300	15160	4,548.0	14	263	263	0.0155	3	2
Sevier	2	WEARS VALLEY RD.	SR073	321	4.692	6.170	1.478	9190	13,582.8	2	--	--	0.0463	4	2
Sevier	3	HWY. 411 / US-441	SR071	441	0.000	13.116	13.116	7090	92,992.4	6	--	--	0.5237	3	2
Sevier	3	VETERANS BLVD.	SR449	--	3.371	6.200	2.829	17660	49,960.1	16	263	263	0.2814	4	2
Sevier	4	WYE DR.	1295	--	0.000	3.390	3.390	2740	9,288.6	8	--	--	0.0693	3	2
Sevier	4	GLADES RD.	1284	--	0.000	3.200	3.200	4960	15,872.0	8	112	--	0.1184	4	2
Shelby	1	I40	I0040	--	8.620	10.360	1.740	87630	152,476.2	11	191	191	0.1243	4	1
Shelby	1	I-240	I0240	--	19.210	19.430	0.220	194040	42,688.8	11	191	191	0.0348	5	1

County	FC Strat	Road Name	Route	US Rte Number	Begin Mile	End Mile	Length	AADT	DVMT	FC Num	Incorp. Area Number	Urban Area Number	Prob (Select)	Seln Order	Tier
Shelby	1	I40	I0040	--	7.250	7.530	0.280	84430	23,640.4	11	191	191	0.0193	6	1
Shelby	2	US-HWY. 64	SR015	64	11.620	15.580	3.960	16410	64,983.6	2	--	--	0.0680	4	1
Shelby	2	POPLAR ST.	SR057	72	18.370	19.750	1.380	23010	31,753.8	14	61	191	0.0332	5	1
Shelby	2	COVINGTON PK.	2814	--	8.940	9.500	0.560	20570	11,519.2	14	191	191	0.0120	6	1
Shelby	3	MACON RD.	1458	--	2.370	4.530	2.160	13320	28,771.2	16	--	191	0.0286	4	1
Shelby	3	YALE RD.	2822	--	8.550	9.230	0.680	13860	9,424.8	16	--	191	0.0094	5	1
Shelby	3	APPLING RD.	5135	--	0.000	1.330	1.330	27470	36,535.1	16	--	191	0.0363	6	1
Shelby	4	HAWKINS MILL RD.	2819	--	0.610	1.770	1.160	1810	2,099.6	17	191	191	0.0074	4	1
Shelby	4	BAILEY STATION RD.	5347	--	0.730	1.230	0.500	5260	2,630.0	17	--	191	0.0093	5	1
Shelby	4	REESE RD.	5136	--	0.750	1.440	0.690	7650	5,278.5	17	191	191	0.0186	6	1
Tipton	2	HWY. 51 N.	SR003	51	16.650	17.760	1.110	20220	22,444.2	14	68	68	0.3138	4	2
Tipton	2	US-HWY. 51 S.	SR003	51	2.380	2.720	0.340	25720	8,744.8	14	14	14	0.1223	5	2
Tipton	2	US-HWY. 51 S.	SR003	51	0.600	1.480	0.880	25720	22,633.6	14	14	14	0.3164	6	2
Tipton	3	MUNFORD-ATOKA AVE.	SR206	--	0.000	1.530	1.530	10500	16,065.0	16	208	208	0.3039	3	2
Tipton	3	HWY. 14 S.	SR014	--	4.630	8.990	4.360	2690	11,728.4	6	--	--	0.2219	4	2
Tipton	4	BRIGHTON-CLOPTON RD.	1476	--	0.840	4.050	3.210	2430	7,800.3	8	--	--	0.1272	3	2
Tipton	4	OLD MEMPHIS	1473	--	0.460	5.400	4.940	1950	9,633.0	8	--	--	0.1571	4	2

County	FC Strat	Road Name	Route	US Rte Number	Begin Mile	End Mile	Length	AADT	DVMT	FC Num	Incorp. Area Number	Urban Area Number	Prob (Select)	Seln Order	Tier
		RD.													
Warren	2	MANCHESTER HWY.	SR055	--	11.399	12.070	0.671	10400	6,978.4	14	181	181	0.0998	4	2
Warren	2	NASHVILLE HWY.	SR001	70S	3.972	9.365	5.393	6850	36,942.1	2	--	--	0.5285	5	2
Warren	2	E. COLVILLE ST.	SR056	--	12.682	12.940	0.258	5260	1,357.1	14	181	181	0.0194	6	2
Warren	3	N. CHANCERY ST.	3390	--	0.000	0.710	0.710	8240	5,850.4	16	181	181	0.1214	3	2
Warren	3	OLD SMITHVILLE HWY.	1123	--	0.000	0.467	0.467	7180	3,353.1	16	181	181	0.0696	4	2
Warren	4	MT. ZION RD.	2171	--	0.000	5.905	5.905	590	3,484.0	8	--	--	0.0760	3	2
Warren	4	GREAT FALLS RD.	SR287	--	39.820	40.300	0.480	980	470.4	7	--	--	0.0103	4	2
Williamson	1	I65	I0065	--	6.648	8.725	2.077	62480	129,771.0	1	103	--	0.2633	3	2
Williamson	1	I65	I0065	--	14.670	14.940	0.270	97790	26,403.3	11	103	210	0.0536	4	2
Williamson	2	MURFREESBORO RD.	SR096	--	13.130	13.648	0.518	22310	11,556.6	14	103	210	0.0454	3	2
Williamson	2	MACK HATCHER MEMORIAL PKW	SR397	--	5.700	7.370	1.670	16270	27,170.9	14	103	210	0.1068	4	2
Williamson	3	COLUMBIA PK.	SR006	31	3.070	5.369	2.299	17900	41,152.1	6	345	--	0.1459	3	2
Williamson	3	MOORES LN.	SR441	--	0.000	1.550	1.550	16620	25,761.0	16	32	210	0.0913	4	2
Williamson	4	HENPECK LN.	5505	--	0.000	2.150	2.150	3160	6,794.0	17	--	210	0.0326	3	2
Williamson	4	ARNO-COLLEGE GROVE RD.	980	--	6.290	9.620	3.330	970	3,230.1	8	--	--	0.0155	4	2

Segments for Local Roads[7]

County	Co – RF Stratum	Road Name	Route	Begin Mile	End Mile	Length	Func. Class	Incorp. Area Number	Urban Area Number	Stratum Length	Prob (Select)	Seln Order	Tier
Blount	55	N. FOOTHILLS PLAZA DR.	0C068	0.000	0.282	0.282	U / LOCAL	185	155	1,008.61	0.0028	4	2
Blount	55	JERICHO RD.	0A499	0.000	2.872	2.872	R / LOCAL	--	--	1,008.61	0.0285	5	2
Blount	55	S. LONG HOLLOW RD.	0A631	0.000	1.316	1.316	U / LOCAL	--	155	1,008.61	0.0130	6	2
Davidson	195	ELAINE DR.	0C242	0.000	0.845	0.845	U / LOCAL	210	210	2,278.53	0.0037	4	1
Davidson	195	HASELTON RD.	0C865	0.000	0.759	0.759	R / LOCAL	210	--	2,278.53	0.0033	5	1
Davidson	195	GREAT CIRCLE RD.	0D381	0.998	2.994	1.996	U / LOCAL	210	210	2,278.53	0.0088	6	1
Dyer	235	FAIRWAY DR	0A847	0.220	1.070	0.850	U / LOCAL	87	87	89.47	0.0950	4	2
Dyer	235	MOSS ST	0A188	0.000	0.150	0.150	U / LOCAL	87	87	89.47	0.0168	5	2
Dyer	235	GLENN ST	0A194	0.000	0.070	0.070	U / LOCAL	87	87	89.47	0.0078	6	2
Hamilton	335	NORTH TER.	0B228	0.000	2.018	2.018	U / LOCAL	52	52	1,870.93	0.0108	4	1
Hamilton	335	THATCH RD.	0.00E+00	0.000	4.620	4.620	R / LOCAL	--	--	1,870.93	0.0247	5	1
Hamilton	335	OSAGE DR.	0D540	0.000	1.243	1.243	R / LOCAL	272	--	1,870.93	0.0066	6	1
Knox	475	BURNETT CREEK RD.	0A159	0.000	3.029	3.029	U / LOCAL	--	155	2,470.04	0.0123	4	1
Knox	475	EARLY DR.	0B867	0.000	1.481	1.481	R / LOCAL	--	--	2,470.04	0.0060	5	1
Knox	475	OHIO AVE.	0A848	0.050	0.539	0.489	U / LOCAL	155	155	2,470.04	0.0020	6	1
Loudon	535	BLUE SPRINGS RD.	0A629	0.000	0.180	0.180	R / LOCAL	--	--	562.71	0.0032	4	2
Loudon	535	BRIGHT RD.	0A645	0.000	2.365	2.365	R / LOCAL	--	--	562.71	0.0420	5	2
Loudon	535	SINKING CREEK RD.	0A429	0.000	2.476	2.476	R / LOCAL	--	--	562.71	0.0440	6	2
Marion	585	TRUSSELL RD.	0A541	0.136	1.072	0.936	R / LOCAL	199	--	439.44	0.0213	4	2

[7] Co-RF Stratum = County number (5 – 94) + 5 = Local road stratum; Stratum Length = total mileage in county-stratum.
Prob (Select) = probability that the segment is selected into either the primary segments (Attachment 2) or the secondary segments (this Attachment).

County	Co – RF Stratum	Road Name	Route	Begin Mile	End Mile	Length	Func. Class	Incorp. Area Number	Urban Area Number	Stratum Length	Prob (Select)	Seln Order	Tier
Marion	585	DOGWOOD TR.	0A432	0.000	0.534	0.534	R / LOCAL	276	--	439.44	0.0122	5	2
Marion	585	HAMILTON AVE.	0A607	0.000	0.106	0.106	R / LOCAL	--	--	439.44	0.0024	6	2
McMinn	545	CRESTWAY DR.	0B212	0.065	0.725	0.660	U / LOCAL	13	13	95.36	0.0692	4	2
McMinn	545	CHESTNUT HILL RD.	0B256	0.000	0.426	0.426	U / LOCAL	13	13	95.36	0.0447	5	2
McMinn	545	CLAY ST.	0A705	0.444	0.517	0.073	U / LOCAL	13	13	95.36	0.0077	6	2
Montgomery	635	ROTARY HILLS CT.	0B251	0.000	0.288	0.288	U / LOCAL	55	55	1,311.55	0.0022	4	2
Montgomery	635	MT HERMAN RD.	0A069	0.000	1.807	1.807	R / LOCAL	--	--	1,311.55	0.0138	5	2
Montgomery	635	GRAYS CHAPEL RD.	0A446	0.000	2.494	2.494	R / LOCAL	--	--	1,311.55	0.0190	6	2
Roane	735	ZUMSTEIN DR.	0B116	0.000	0.266	0.266	U / LOCAL	250	250	170.47	0.0156	4	2
Roane	735	--	0A502	1.570	2.780	1.210	U / LOCAL	153	153	170.47	0.0710	5	2
Roane	735	SMITH LN.	0A199	0.000	0.130	0.130	U / LOCAL	126	126	170.47	0.0076	6	2
Rutherford	755	CAPTAIN JOE FULGHUM DR.	0D137	0.000	0.345	0.345	U / LOCAL	209	210	1,497.31	0.0023	4	2
Rutherford	755	BUTTREY CT.	0F449	0.000	0.099	0.099	R / LOCAL	--	--	1,497.31	0.0007	5	2
Rutherford	755	CENTENNIAL DR.	0B909	0.000	0.676	0.676	U / LOCAL	159	210	1,497.31	0.0045	6	2
Sevier	785	VANDERVIEW DR.	0A706	0.066	0.831	0.765	U / LOCAL	--	155	255.22	0.0300	4	2
Sevier	785	NEWELL VILLAGE DR.	0C222	0.000	0.281	0.281	U / LOCAL	--	155	255.22	0.0110	5	2
Sevier	785	THURMAN CIR.	0C043	0.000	0.358	0.358	U / LOCAL	263	263	255.22	0.0140	6	2
Shelby	795	DOUGLAS RD	0D944	0.000	0.800	0.800	U / LOCAL	11	11	2,351.00	0.0034	4	1
Shelby	795	VERNE RD	0B192	0.000	0.430	0.430	U / LOCAL	191	191	2,351.00	0.0018	5	1
Shelby	795	KENASHA ST	0G445	0.000	0.160	0.160	U / LOCAL	191	191	2,351.00	0.0007	6	1
Tipton	845	ALONZA LN.	0A871	0.000	0.330	0.330	R / LOCAL	--	--	660.91	0.0050	4	2
Tipton	845	CORONA RD.	0A558	0.000	5.310	5.310	R / LOCAL	--	--	660.91	0.0803	5	2
Tipton	845	GAINESVILLE LN.	0A144	0.000	0.890	0.890	R / LOCAL	--	--	660.91	0.0135	6	2

County	Co – RF Stratum	Road Name	Route	Begin Mile	End Mile	Length	Func. Class	Incorp. Area Number	Urban Area Number	Stratum Length	Prob (Select)	Seln Order	Tier
Warren	895	LANCE ST.	0A696	0.000	0.311	0.311	U / LOCAL	181	181	75.80	0.0410	4	2
Warren	895	PINECREST ST.	0A670	0.000	0.234	0.234	U / LOCAL	181	181	75.80	0.0309	5	2
Warren	895	FISHER ST.	0A654	0.000	0.156	0.156	U / LOCAL	181	181	75.80	0.0206	6	2
Williamson	945	LIBERTY PK.	0C451	0.000	0.678	0.678	U / LOCAL	103	210	1,259.13	0.0054	4	2
Williamson	945	COX RD.	0A846	0.000	5.234	5.234	R / LOCAL	--	--	1,259.13	0.0416	5	2
Williamson	945	OLD CARTERS CREEK PK.	0A547	0.687	1.065	0.378	U / LOCAL	--	210	1,259.13	0.0030	6	2

Attachment 4: Seat Belt Observer Instructions

These instructions describe procedures for observing seat belts and motorcycle helmet use, including where to stand at an intersection, what to look for, and coding. Please keep these instructions handy for quick review.

1. Observation Sites

This is the first time that this specific design and list of observation sites has been used. You may be the first person to actually visit the site. If so, it will be up to you to find a suitable location for observation or, if the road is in some way compromised (closed or under construction) so that normal traffic can't occur, disqualify the site and arrange with your supervisor to move to an alternate site.

You will be given a general map of the road segment on which you are to observe (together with the time and day of week for observation). A point along the segment will be identified as the preferred location for seat belt use observation, as well as the direction of travel to observe. If this direction would be very much harder to observe than the other, either because of safety issues for you or traffic or for observation problems such as sun glare, choose the other direction. If you change the direction to be observed, record the reason on the Field Data Form.

Next, find a specific location for observing. The general map will show the length of road, or identify possible highway exit ramps, on which observations can be made. Select a spot where you can observe safely, without risk to yourself or to traffic (e.g., by being a distraction or by impeding their view), and where you can readily observe the belt use of drivers and outboard front seat passengers.

It is recommended that you first look for a place where traffic must slow naturally, for a traffic control (stop signs are better than traffic signals) or a sharp curve on an expressway exit ramp.

When you have selected the exact location for observing, show the location on your general map and then make a detailed "site map" – a drawing that shows where to stand, the traffic flow you're observing, the names of the intersecting roadways, nearby buildings, etc. – on the Field Map Form.

2. Observation Days and Times

You will receive a schedule that has assigned observation locations with day of week and time of day. You must adhere to this schedule if at all possible. (Observe in poor weather as long as you can stay dry (enough) and your ability to make accurate judgments is not compromised.)

You need to observe for 45 minutes at each site (75 minutes at each Local Road site). The observation period should be continuous and should fall entirely within the observation period. Use the extra time in observation periods to move between sites, load and unload observation gear, locate and document your observation positions, eat snacks, etc.

3. List of Sites

In your packet of materials is your list of observation sites, together with maps, descriptive information (road names, cross streets, etc.) and day-of-week and time-of-day schedule.

4. What to Do if a Site Is Unusable/Inaccessible

Alternate sites with the same information are also provided. If you determine that the primary site cannot be used, you must call your supervisor to obtain an alternate site. The alternate will be in the same county and of the same roadway type ("stratum").

If you must use an alternate site, indicate on the general map for the primary site why you can't use it. Then go on with your schedule. The alternate site must be observed on the same day of the week and time of day as the site you had to abandon. If you can observe there "today" in the proper time period, do so; if not, schedule it for a coming week.

5. Which Roadway and Direction to Observe

It is important to recognize that one cannot simply choose to observe traffic on either of the intersecting roadways at an intersection. The roadway and the direction to observe are clearly indicated on the general site map and in your site schedule. You must observe traffic on this roadway traveling in the indicated direction (unless you had to change directions in Step 1).

6. Which Vehicles to Observe

a. **Passenger vehicles**. Code passenger cars, pickup trucks, sport utility vehicles (SUVs), and vans that are less than 10,000 GVWR. Include private, commercial, and emergency vehicles if they fit one of the previous categories. **Include** modified vehicles, such as campers, RVs, and ambulances, which clearly started as one of the passenger vehicle categories like pickups or vans. **Exclude** large buses, heavy trucks, farm equipment, etc.

b. You will have selected an observation point where you expect you will be able to code nearly every qualified vehicle. If you are near a stop-sign-controlled intersection (or a roundabout, or some other location where all traffic is slowed), or on a roadway where traffic speeds and volumes are moderate, this is realistic. If you are near a signal-controlled intersection, you may find that free-flowing traffic on the green signal is moving too fast. In that case, go to step (c). The goal is to have very few "unsures".

c. If you need to observe traffic stopped/slowed by a red light, begin observations with the **second** vehicle in a line of vehicles stopped at the traffic signal (first vehicle if there is only one). Code restraint use by occupants of that vehicle, then code the next vehicle in line, etc. Continue until the vehicles begin to move too rapidly with the green signal.

d. On surface streets with multiple lanes of approaching traffic, code traffic from all lanes if possible. If you are observing at a signal-controlled intersection, begin with the second vehicle in the near lane (first if only one vehicle stopped), then the second in the next lane, etc., to the third in the near lane, etc. For the next red signal, begin with the second (first, if only) vehicle in the lane you left off at on the preceding signal phase.

e. In the case of freeway exits, find a location controlled by a sharp turn, a stop sign, or a traffic signal so that you can observe nearly all vehicles that slow down. If possible, do not choose a location where the only vehicles that slow down are ones that can't merge smoothly, since that would bias your selection to that category of drivers.

f. **Motorcycles**: You should also code motorcycle driver/rider helmet use. For very busy roads, code helmet use for motorcycles traveling in the same direction as the passenger vehicles you are coding for belt use. For less busy streets, as long as it does not interfere with seat belt observations, code motorcycles traveling in both directions.

7. Heavy Traffic Conditions

It is possible that, in heavy traffic conditions, there is an "unending" line of vehicles in the flow of traffic. In this situation, **use a reference point** to randomly determine which is your next vehicle up the road to observe regardless of lane. Pick your reference point some distance up the road. The next vehicle to pass the point is the next vehicle to observe. In other words, after recording data for the current vehicle, look up and record data for the next qualified vehicle passing your reference point.

8. How Long to Observe

Remain observing at each site for 45 minutes (75 minutes for Local Roads). A fixed observation period translates to high volume roadways contributing more observation data than low volume roadways.

9. Observing in Bad Weather.

Do not observe if it is raining too hard or other inclement weather arises. If you arrive at a site and it begins to rain, do not collect data in the rain. Find a dry place and wait 15 minutes to see if the rain stops. If the rain does stop, begin observing again and extend the observation period to make up for the time missed. Otherwise, you will have to reschedule the site (same time of day and day of week). (Note: Observer may continue observations in light fog, drizzle, or mist.)

10. Whom to Observe

a. **Front seat drivers and outboard passengers**. If there are more than two occupants in the front seat, only observe the driver and the passenger (regardless of age) closest to the passenger-side door. Thus, if there are three occupants in the front seat, you would ignore the middle occupant. Do not record children who are in child restraint seats; record all other children in the outboard passenger position, even those in booster seats.

b. **Motorcycle drivers and passengers**. Observe the driver (rider) and, if there is a passenger behind the driver or in a sidecar, code an observation for that person.

10. What to Observe

a. **All**. As you observe a qualifying vehicle, record the type of vehicle (1=car, 2=truck, 3=SUV, 4=van, 5=motorcycle) and the sex (1=male, 2=female, 3=unsure), and shoulder restraint use (1=yes, 2=no, 3=unsure) of the front seat occupants (driver and front seat "outside" passenger only) or helmet use (1=yes, 2=no, 3=unsure) of motorcyclists.

b. **Front seat drivers and outboard passengers**. Code <u>restrained</u> (1=yes) if you see a shoulder belt in the proper position across the front of the person. If you notice a lap belt in use without a shoulder belt, it should be recorded as <u>not restrained</u> (2=no). Only shoulder belts are to be counted. Even if the vehicle likely has no shoulder belts, code the occupant(s) as <u>not restrained</u>. If the person is using the shoulder belt improperly, e.g., has the shoulder strap under his/her arm or behind the back, this should be recorded as <u>not restrained.</u> Code unsure (3) only if you can not tell whether a shoulder belt is properly used.

c. **Motorcycle drivers and passengers**. Code <u>restrained</u> if the person has a motorcycle safety helmet strapped in position. Code <u>not restrained</u> if there is no helmet, if the strap is not fastened, or if it is a bicycle helmet or other improper motorcycle safety helmet.

11. Returning Materials After Completing Observations

Make sure to return all materials back to your supervisor.

a. Completed coding forms (please staple all forms from the same site together in order)
b. Field Map Forms (with any changes noted – only after the last survey)
c. County maps (with any changes noted – only after the last survey)

12. General Tips

Conducting seat belt observations is not particularly hard work, but it is tedious and demanding work. Conditions are often hot and humid in the summer and cold and wet in the winter. Observers must make a special effort to maintain the quality of the observations. Here are some tips and recommendations based on years of conducting these observations.

1. Dress for the work. In the summertime, a hat, sunscreen and sun glasses are essential. If you don't have the complexion that will allow several hours in the sun, you should wear long pants and long-sleeved shirts. The discomfort that comes with the heat is much more bearable (and considerably shorter) than a severe sunburn. If you are out in cold weather, wear layers of clothing and take care of your feet, hands, and head with proper foot, hand, and head gear.

2. Wear an orange or yellow safety vest at all times. Drivers are wary of people hanging around corners peering into cars, especially if they have kids in the car. The vest gives you an "official" air that may put drivers at ease. Still, don't be insulted by windows going up, doors locking, etc.

3. Keep the identification project letter handy. Keep contact names and numbers of our local police contacts (these officials know you are there conducting research).

4. Patrolling police officers and others will likely not be aware of the project. If anyone asks what is being done, explain it to them and show them the letter.

5. Be thoroughly familiar with all the data collection procedures. Just one person consistently making the same mistakes can bias the results. The point of this research is to get an accurate reading of seat belt usage so education campaigns can be developed for low usage groups. Accurate information is of paramount importance.

6. Each observer is ultimately responsible for his/her work, as well as safety. Remember, observation requires that you stand close to traffic. Stay alert and be ready to react.

Attachment 5: Seat Belt Data Collection and Site Forms

The Data Collection Form is shown on next page, followed by the Field Data Form.

Tennessee Seat Belt Observation Form

SITE NUMBER:_____ **SITE:**_____

NOTES:_____

DATE: _____ **–** _____ **–** _____ **DAY OF WEEK:** _____

WEATHER CONDITIONS (circle)
1 Clear / Sunny **4 Fog**
2 Light Rain **5 Wet but Not Raining**
3 Cloudy

DIRECTION OF TRAFFIC FLOW OBSERVED (Circle one): N S E W

START TIME:_____ **(Observation period will last exactly 45 minutes) (75 minutes for Local Road sites)**

	DRIVER			PASSENGER			DRIVER			PASSENGER	
Veh. #	**Vehicle** C = car T = truck S = suv V = van M = mtrcycle	**Sex** M = male F = female U = unsure	**Use** Y = yes N = no U = unsure	**Sex** M = male F = female U = unsure use ?? = unsure if present	**Use** Y = yes N = no U = unsure	**Veh. #**	**Vehicle** C = car T = truck S = suv V = van M = mtrcycle	**Sex** M = male F = female U = unsure	**Use** Y = yes N = no U = unsure	**Sex** M = male F = female U= unsure sex ?? = unsure if present	**Use** Y = yes N = no U = unsure
1						36					
2						37					
3						38					
4						39					
5						40					
6						41					
7						42					
8						43					
9						44					
10						45					
11						46					
12						47					
13						48					
14						49					
15						50					
16						51					
17						52					
18						53					
19						54					
20						55					
21						56					
22						57					
23						58					
24						59					
25						60					
26						61					
27						62					
28						63					
29						64					
30						65					
31						66					
32						67					
33						68					
34						69					
35						70					

FIELD MAP FORM

USE THIS FORM IF THIS IS THE FIRST TIME THE OBSERVATION SITE IS VISITED

PROVIDE:

- **A BRIEF DESCRIPTION OF WHERE YOU ARE STANDING**
- **DIRECTION YOU ARE LOOKING (INDICATE WITH ARROW AND LABEL)**
- **DIRECTION OF TRAFFIC YOU ARE OBSERVING**
  (INDICATE WITH MULTIPLE ARROWS SHOWING TRAFFIC FLOW AND LABEL)
- **SHOW AND LABEL INTERSECTING ROADS, NEARBY BUILDINGS OR LANDMARKS**

SITE NUMBER: _____

OBSERVATION SITE DESCRIPTION:

_____

_____

_____

MAP DRAWING:

Attachment 6. Belt Use Survey Design and Calculations: Overview with respect to missing site data

Please see the discussion below, which summarizes our approach to adjusting for sites which, for any reason, do not contribute valid data to the survey. It is a response based on the Westat 2/13/2012 *Non-Response Adjustment in CT's Estimator* memo.

We appreciate the effort you have put into the 2/13 memo and agree with its conclusions. We believe that our approach is entirely consistent with that memo.

Context

Assume a belt use survey design which is based on sample counties (e.g., 6-15) broken down by roadway type strata into county-road stratum combinations (e.g., 5 road type strata in all with each county having qualified roadways in 3-5 of the strata) and a number of observation sites for each county-road stratum (e.g., 2-3 sites).

Further, assume that for each county-road type stratum there is a pool of selected sites, randomly distributed into primary observation sites and spare sites, with the spares available to use in case one of the primary sites is unusable. Assume there are no further distinctions among the sites, e.g., no "layering" of them by DVMT levels, and no "pairing" where one primary site is linked to a specific spare site.

Assume that belt use calculations are based on a 4-step process:

- Formula 1, which combines the belt use observations from the sites within each county-road stratum to produce a county-road stratum belt use rate.
- Formula 2, which combines all of the county-road stratum belt use rates in each county to produce a county belt use rate.
- Formula 3, which combines all of the county belt use rates in each county tier to produce a tier belt use rate.
- Formula 4, which combines the two tier belt use rates to produce a statewide belt use rate.

Finally, assume there is an observation plan and schedule which is ready to be implemented to yield the desired statewide belt use rate.

Data Collection with Possible Missing Site Data

The goal is to follow the observation plan so that valid observations are obtained for every site in the design. There is the possibility, however, that not all will go according to plan. Our first, and main, line of defense is to make concerted efforts to collect valid data, at the primary sites if possible or at qualified alternate sites if necessary.

For each site:

1. Attempt to collect belt use observations according to the schedule.
    a. Success: Done

b. Failure:
    i. If the site is a valid site but initial data collection efforts were unsuccessful, reschedule the site and return to 1 (i.e., try again).
        1. Some possible reasons for initial failure include bad weather, temporary traffic emergency rerouting, observer oversleeping, or data falsification.
    ii. Even if the site seems valid, if initial and repeat data collection efforts are unsuccessful, depending on the reasons why, replace the initial site with the next available alternate (same county-road stratum, of course), reschedule, and return to 1.
    iii. If the site is not a valid site or cannot be observed, replace it with the next available alternate, reschedule, and return to 1.
        1. Some possible reasons include roadway of the wrong type (e.g., is a Collector when the desired stratum is Local), has long-term construction, or is dangerous for the observer.
    iv. If no reasonable efforts can produce valid data for this site or a qualified alternate site in its place, declare failure and move on to belt use calculation.

Belt Use Calculation Adjustment for Missing Site Data

In general, if an alternate site is used in place of a primary site, the alternate site's weight is used in the calculation of Formula 1.

Conditions of missing site data and appropriate adjustments:

1. One or more sites of a county-road stratum is missing but there are one or more sites remaining with valid data:
    a. Estimated odds of occurrence, about 1 in 1000 for one site missing, about 1 in 10,000 or less for more than one site missing.
    b. Adjustment: Use Formula 1 for this county-road stratum to compute the (weighted) average of the belt use rates of the remaining site(s), as described in *Non-Response Adjustment in CT's Estimator*, Westat, 2/13/2012.
2. Every site within a county-road stratum missing, i.e., no valid data could be collected at the primary site(s) or any of the alternate sites.
    a. Estimated odds of occurrence, about 1 in 10,000 or less.
    b. Adjustment: Use Formula 2 for this county to compute the weighted average of the belt use rates of the remaining strata within the county.
3. More extensive missing data problems:
    a. Estimated odds of occurrence, near zero.
    b. Adjustment: This would signify a fundamental failure of the design or the data collection effort. Any adjustment would be based on a whole-system analysis, evaluation, and solution and would be outside the scope of this document.