2023 Safety Belt Usage Survey in Kentucky

Kentucky Transportation Center

Research Report

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Table of Contents

List of Figures

List of Tables

Chapter 1 Introduction and Background

The use of safety belts is a proven means of reducing injuries to motor vehicle occupants involved in traffic crashes. Promoting and supporting safety belt usage is a top priority for transportation safety officials across the country. For years, there have been various methods used in efforts to increase safety belt usage. Past efforts have included public information campaigns, local and statewide legislation, and enforcement of the legislation.

In order to evaluate the effectiveness of these efforts, statewide observational surveys are conducted. The first observational surveys were conducted in Kentucky in 1982 in tandem with a law that was passed by the 1982 Kentucky General Assembly that mandated a "restraint system" for children 40 inches or less in height. Annual surveys have been conducted ever since. In the first several years of the survey, seatbelt usage increased quickly, from four percent in 1982 to 42 percent in 1993. In 1994, Kentucky included mandatory seatbelt usage as a secondary enforcement law, meaning that law enforcement officials may penalize a vehicle occupant for not wearing a seatbelt if the driver is already being penalized for a separate infraction. In 2006, the seatbelt law became mandatory via primary enforcement, in which law enforcement officials may conduct traffic stops and write citations for lack of seatbelt usage without other infractions. Primary enforcement also coincided with a continuing increase in seatbelt usage. Examples of the increasing rates are 60 percent in 2000, 66 percent in 2004, 73 percent in 2008, and 86 percent in 2014. Usage rates have leveled off in more recent years, staying just under 90 percent. Still, collecting and understanding the safety belt data is a critical part of pursuing progress within the realm of transportation safety.

Historically, this survey has included child safety seat presence, motorcycle helmet usage, and bicycle helmet usage as well as safety belt usage. Due to a variety of reasons, including relatively steady rates and difficulty collecting data, those aspects have since been removed from the study.

This study involved collecting and evaluating data from across the state to establish the safety belt usage rate in Kentucky for 2023. The effort supports the National Highway Traffic Safety Administration (NHTSA) seat belt safety initiatives. The survey began immediately after completion of the annual "Click It or Ticket" campaigns, lasted for ten weeks, and involved collecting data at 150 sites across 15 counties. Data from the individual sites were weighted and summarized into a statewide percentage. The resulting usage rate is presented in a variety of ways, considering attributes such as roadway functional classification, county, motor vehicle type, and amount of traffic. To statistically analyze the data and draw valid conclusions, the research team was comprised of transportation engineers with decades of experience in seatbelt studies as well as a licensed statistician. Kentucky's rate from 2023 is valuable knowledge in itself but becomes more useful when compared to those determined from previous surveys, which are included in the report. The 2023 survey and subsequent report represent continued documentation of the effect associated with safety belt legislation, related education campaigns, and general public attitude.

Chapter 2 Survey Methodology

New survey sites were selected for 2023, as is required every five years. The survey design follows what has been done in recent years and is in accordance with NHTSA's Federal Register, Vol. 76, No. 63, Subpart B. The approach is considered a complex multistage sampling design. This chapter details the full process, from selecting counties to identifying data collection sites.

2.1 Selection of Counties and Number of Sites in Each County

- The number of highway fatalities was summarized for each of Kentucky's 120 counties for the five-year period of 2016 through 2020. The source of the data was NHTSA's Fatality Analysis Reporting System (FARS), which provides yearly crash summaries. The occupant fatality totals were sorted, and those counties with fatality rates in the lowest 15th percentile were excluded from consideration. The result was a sample of 75 counties that were considered as eligible survey counties.

- While the number of data collection sites has varied in the past, all survey methodologies have resulted in a standard error of approximately one percent. Since 2013, the survey has comprised 150 sites in 15 counties. This is roughly 20 percent of the eligible counties.

- To ensure a geographically representative sample of counties across Kentucky, the selection methodology involved randomly selecting a county in each of the 12 Transportation Cabinet highway districts. The districts have similar numbers of counties and provide a good distribution across the state. Three of the districts include the major urban areas in the state. Two counties were selected in each of these three urban districts, which resulted in the selection of a total of 15 counties.

- The only exception to the random selection was the automatic selection of Jefferson and Fayette Counties (in two of the urban districts). This was done because these counties (which contain Louisville and Lexington) have much higher vehicle miles traveled than any other county. Any meaningful statewide sample must include these counties because they are the largest urban centers in Kentucky.

- The objective was to identify 150 data collection sites in the 15 selected counties. Based on the results from past data collection, this number of sites would easily meet the 2.5 percentage point standard error criterion. Additional data would be collected if the standard error exceeded 2.5 percent.

- Past experience has shown that the number of vehicles observed varies dramatically by the site (depending on the average daily traffic [ADT] at the site). It is expected that there will be at least 50 observations made at every site. The total statewide sample size should be over 50,000.

- The number of sites selected in each county was based on the vehicle miles traveled (VMT) in each county. In past survey designs, it was stated that the number of sites in each county was "roughly proportional" to its VMT and clusters were formed based on "intuitive cutoff points". This year, further statistical rigor was introduced at this step of the design: a k-means cluster analysis was performed on the county VMTS. This selects the optimal number of groupings. In this case, five clusters were identified. A cluster can include one or several counties.

- Using a linear Diophantine equation, each cluster is assigned a number of data collection sites. Solutions were constrained to multiples of three, and ensured that the total number of sites in the state was 150.

- Counties with lower VMT have fewer assigned data collection sites than counties with higher VMT. The number of sites in a county varies from six to 24.

- Table 2.1 lists the counties selected. The numbers of fatalities and VMT are given for each county. The five clusters of counties are delineated, and the number of sites in each county is noted.

Table 2.1 Selected Counties

County	Highway District	VMT (x1000)	VMT Cluster	Number of Sites
Pendleton	6	105774	1	6
Wolfe	10	107970	1	6
McCreary	8	159942	1	6
Harlan	11	198372	1	6
Larue	4	212646	1	6
Greenup	9	298290	1	6
Jessamine	7	388692	2	9
Floyd	12	402234	2	9
Marshall	1	500688	2	9
Franklin	5	525576	2	9
Barren	3	604266	2	9
Christian	2	1009062	3	12
Kenton	6	1431792	3	12
Fayette	7	2845284	4	21
Jefferson	5	6866526	5	24

- The following map shows the location of the districts and counties across the state. This map includes the mini-survey locations as well (see Section 3.3 for more information.)

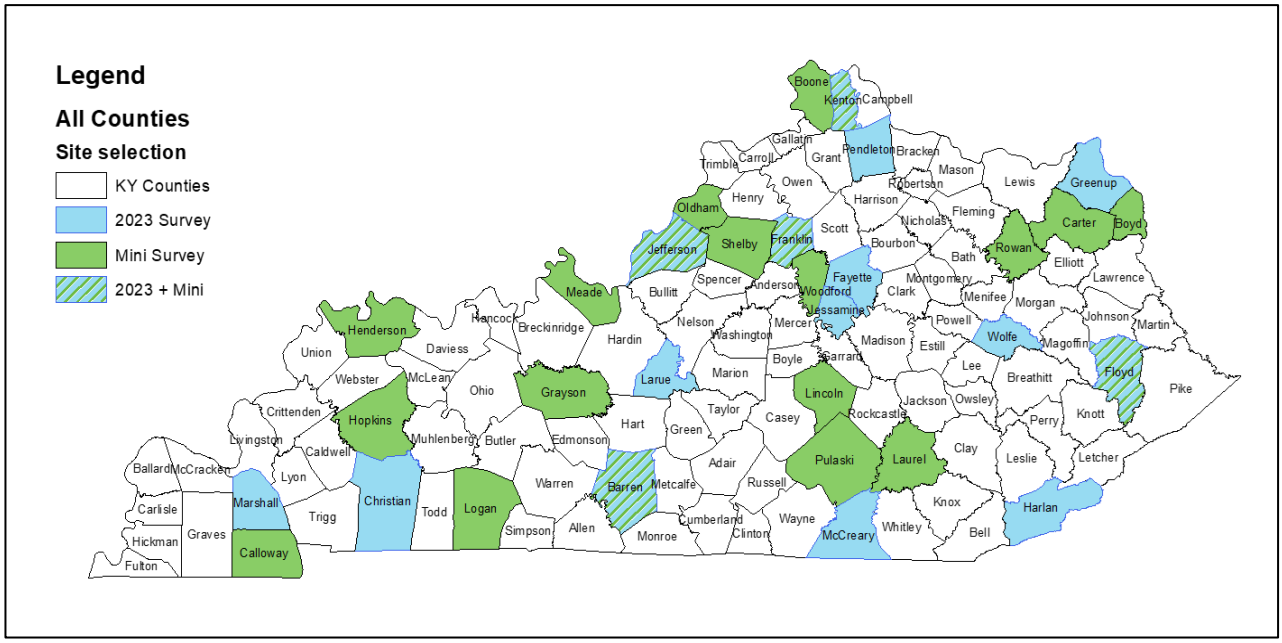


Figure 2.1 Map of Selected Counties in Kentucky

2.2 Assign Sites by Highway Type

- After the counties and the total numbers of data collection sites in each county were determined, the next step was to assign the number of sites by highway type. Sites within a county were selected using a complex stratified random sampling, treating the counties as the stratum and road class as the stratification unit.

- The following three roadway types (road class stratum) were used:
    1. limited access; primary
    2. arterials; secondary
    3. local; tertiary

- Using the primary/secondary/tertiary classification system to stratify the roads within each county, the appropriate number of segments were selected within each group for the selected counties.

- Within a county, the candidate sites were subset into (at most) three functional classes: “primary”, “secondary”, and “tertiary”. Adjustments are made if a functional class did not have any roads in the county. (In six of the 15 selected counties, there were no roads in the “limited access” category so no primary road segments were included.)

- The number of sites was then divided up proportional to the total VMT for a roadway type relative to the overall county VMT. After rounding to the closest integer, if the sum of the number of sites did not equal the number of sites stated in the table, one site could be added or subtracted accordingly.

- R was employed for the county and site selection process. The R code is provided in Appendix G.

- Using the criteria as noted, the following data (Table 2.2) presents the number of sites by county and highway type. Of the 150 sites, there are 46 sites on limited-access roadways, 66 sites on arterials, and 38 sites on tertiary roads.

Table 2.2 Number of Sites in Each County by Road Class

Stratum: County	Total Number of Sites Allocated	County VMT (x1000)	Stratification Unit: Road Class	Population (DVMT)	Sample Count
Barren	9	604266	Primary	500346	3
			Secondary	433439	3
			Tertiary	357983	3
Christian	12	1009062	Primary	1319052	6
			Secondary	823310	4
			Tertiary	327696	2
Fayette	21	2845284	Primary	2941893	9
			Secondary	3052968	9
			Tertiary	809307	3
Floyd	9	402234	Primary	0	0
			Secondary	678149	6
			Tertiary	362911	3
Franklin	9	525576	Primary	577855	4
			Secondary	686795	4
			Tertiary	122045	1
Greenup	6	298290	Primary	0	0
			Secondary	538447	5
			Tertiary	171954	1
Harlan	6	198372	Primary	0	0
			Secondary	347930	4
			Tertiary	195996	2
Jefferson	24	6866526	Primary	9444963	13
			Secondary	6862556	9
			Tertiary	1422504	2
Jessamine	9	388692	Primary	0	0
			Secondary	683020	7
			Tertiary	188980	2
Kenton	12	1431792	Primary	2260467	7
			Secondary	907075	3
			Tertiary	550094	2
Larue	6	212646	Primary	161769	2
			Secondary	205444	3
			Tertiary	81110	1
Marshall	9	500688	Primary	648000	4
			Secondary	355044	3
			Tertiary	251450	2
McCreary	6	159942	Primary	0	0
			Secondary	182092	4
			Tertiary	114095	2
Pendleton	6	105774	Primary	0	0
			Secondary	144036	4
			Tertiary	82068	2
Wolfe	6	107970	Primary	116825	2
			Secondary	62979	2
			Tertiary	62209	2

2.3 Selection of Data Collection Sites

- After the counties and number of sites (by roadway type) in each county were selected, the next portion of the methodology involved: a) randomly selecting roadway segments in each roadway type and b) selecting specific sites within each segment.

- The road segment database employed KYTC's "All Roads" network file. The Kentucky All Roads file includes all public roads and is updated weekly. Within the dataset, some allowed exclusions were made, namely rural local roads, nonpublic roads, and the like. Using ArcGIS, the All Roads file was combined with Functional Classification data and Traffic Counts data. For each segment, Daily Vehicle Miles Traveled (DVMT) was used as the Measure of Size (MOS).

- Using the primary/secondary/tertiary classification system to stratify the roads within each county, the appropriate number of segments were selected within each group for the selected counties. Appendix B provides a map of site locations by highway type.

- The segment length (in terms of VMT) was factored into the selection process, with longer sections having a higher probability of selection than shorter sections.

- Within a functional class, the sampling weights for the road segments are determined by dividing each road segment's DVMT by the total DVMT for that functional class within that county. Then road segments were selected by sampling without replacement according to these sampling weights.

- The probability of selection (POS) was the probability of selecting a site from a functional class multiplied by the sampling weight used when drawing sites from within a county.

- Within the selected segment, observation points were identified. The segments were inspected either remotely, using online imagery, or through a site visit. Site selection ensured that the observers could obtain data safely and effectively. Often, this meant positioning the observer(s) at an intersection or overpass so they have an unobstructed view of traffic while not being too close to it.

- If applicable, the number of approaches (by direction of travel) and lanes on the approaches on the specified road were identified at each site. The approach and lane used to collect data were randomly selected.

- Appendix A (Table A1) contains a list of the 150 data collection sites. The county and road name or number are given along with a reference to locate the observation site. The highway where the data is to be collected is identified. Each site's VMT and the county VMT are given. The probability of selection for each site is provided.

- For each roadway type within a county, one additional segment was selected to serve as the "Alternate." These alternates were utilized if no appropriate data collection observation point could be found within the original segment or if an identified observation site was unavailable for a substantial period of time (i.e. construction work). The list of alternates is provided in Table A2 of Appendix A.

- Since 2023 was the first year of a new survey, there were a few alternates used during the survey; the five that were utilized this year are identified in Appendix E. To remain consistent, alternative sites will replace original sites in future iterations of this survey.

2.4 Data Collection Procedure

- Sites were clustered together for observation to maximize efficiency (and minimize time and travel costs). Sites in relatively close proximity to one another were designated data collection clusters. However, if there were multiple sites along the same road, care was taken to put them in different clusters to allow for a range in data observation days/times. Each cluster was assigned a random day for data collection. Within the cluster, data collectors could choose the order of sites to optimize their travel route that day.

- Data were collected for one hour at each site with either one or two data collectors (depending on the number of directions of travel included). One hour was required if the data were gathered by one data collector in one direction of travel, whereas one half hour was needed if there were two data collectors in separate directions of travel. There is a reasonable assumption that, for sites where one observer is used, the observed vehicles in one direction on a specific route in one hour will equal the number of vehicles on both directions on that route in a half hour. Sites requiring only one observer are divided roadways, low-volume roads, or T-intersections. On roads with higher traffic volumes, an equal distribution of traffic flow in each direction cannot be assumed; therefore, two observers were used, with one observing each direction. The use of a variable observation period (as described) does not affect the probability of selection.

- Data collection was scheduled to occur between June 1 and August 11. Data collection guidelines stated that data would be collected between 8 am and 6 pm on weekdays. The schedule included rush hour and non-rush hour observations. Start times were staggered to ensure the surveys captured a representative number of sites for each day of the week and time of day.

- Data were collected through direct observation. Appendix C contains the form used to collect and record data. Data were collected using paper forms. The form allows data collectors to record information such as the site number and the date and time of data collection. For drivers and front seat passengers, the categories are:
    1. Safety belt used (shoulder belt is in front of shoulder),
    2. Safety belt not used (shoulder belt not in front of shoulder), and
    3. Unknown (cannot be determined if belt is used).

- The presence or absence of a passenger in the right front seat is shown by comparing the total number of drivers and passengers in the sample size. Observation for any right seat passenger was obtained for all vehicles. The number of vehicles at a site with only a driver can be calculated by subtracting the total number of front seat passengers from the total number of vehicles observed. The ratio of the total number of recorded unknown values of belt use to the total number of drivers and passengers observed must not exceed 10 percent. Additional data were collected if the nonresponse threshold was surpassed.

- The following vehicle types (both in-state and out-of-state vehicles) were included in the data collection:
    1. Passenger car (PC)
    2. Pickup (PU)
    3. Van
    4. Sport utility vehicle (SUV)

- Before starting data collection, data collectors were provided training on the data collection procedure. The classroom training included:
    1. An overview of the survey and project background
    2. Data clusters and scheduling observations

3. How to collect data through direct observation and use of the data form
4. Data input for analysis

After the classroom portion of the training, the data collectors conducted trial surveys at locations representative of the three roadway types included in the survey. The project manager was present during these trial surveys to provide guidance. The trial survey results were evaluated to ensure that the data collectors provided consistent and accurate data compared to each other and compared to the project manager.

- Drivers received no indication that the data collectors were conducting a safety belt survey. For high volume locations, randomized selection was achieved by recording data for the next vehicle in view after recording the previous data. At low volume locations, data for the driver and outboard front seat passenger were obtained for all vehicles so there was no need for a random selection. For each vehicle, the usage for the driver and any outboard front seat passenger was noted. At intersections, data were collected for vehicles either stopped or moving slowly enough to observe. At overpasses on limited access highways, an observation position was chosen to allow for an unobstructed view of the vehicle's front seat.

- A quality control monitor conducted random, unannounced visits to collect data at ten of the data collection sites. There were four data collectors and one quality control monitor. The objective was that data were compared for at least two sites for each data collector.

2.5 Usage Rate Calculations

The following paragraphs summarize the calculation used to estimate the statewide seat belt usage rate. Seat belt usage rates were calculated using formulas based on the proportion of the state's total vehicle miles traveled (VMT) represented by the site. The seat belt usage rate calculations followed a four-step process.

- First, estimated rates were calculated for each of the road strata within each county. Observed usage rates for all sites within each stratum-county combination were combined through simple averaging, as shown in the following formula (1). (Since the sites' original probability of being included in the sample was proportional to their VMT, averaging their usage rates makes use of that sampling probability to reflect their different VMTs).

$$p_{i(j)k} = \sum_{l=1}^{n_{i(j)k}} p_{i(j)kl} \,/\, n_{i(j)k} \qquad \text{(Eq.1)}$$

where *i(j)* = county *i* within category *j* (category 1 = one randomly selected county, category 2 = the two districts in which one county was random and one county was forced, and category 3 = two randomly selected counties); *k* = road functional class stratum; *l* = site within stratum and county; $n_{i(j)k}$ = number of sites within the stratum-county combination; 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 (excluding unknown usage) whose belt use was observed at the site).

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

$$p_{i(j)} = \frac{\sum_k VMT_{i(j)k}\, p_{i(j)k}}{\sum_k VMT_{i(j)k}} \qquad \text{(Eq. 2)}$$

where $VMT_{i(j)k}$ = VMT 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 were obtained by combining and weighting the rates from the sampled counties in each category by their VMT values and probabilities of being selected:

$$p_{i(j)} = \frac{\sum_i VMT_{i(j)} W_{i(j)} p_{i(j)}}{\sum_k VMT_{i(j)} W_{i(j)}} \quad \text{(Eq. 3)}$$

where $VMT_{i(j)}$ = total VMT for county *i* in category *j* and $W_{i(j)}$ = the inverse of the probability of the county's selection: where j is one of the three following categories:

<u>One county randomly selected from district (j = 1)</u>
Highway Districts 1,2,3,4,8,9,10,11, and 12

$$W_{i(1)} = \frac{\sum_{L=1}^{x_m} VMT_{L(1)}}{VMT_{i(1)}} \quad \text{(Eq. 4)}$$

where m = county i's district, x_m = the number of counties in District m, L is the L^{th} county in District m, $VMT_{L(1)}$ = the VMT in county L, $VMT_{i(1)}$ = the VMT in county i.

<u>One county randomly selected from district and one county certainly selected (j = 2)</u>
Highway Districts 5 and 7

$$W_{i(2)} = \frac{\sum_{L=1}^{y_m} VMT_{L(2)}}{VMT_{i(2)}} \quad \text{(Eq. 5)}$$

where m = county i's district, y_m = the number of counties in district m excluding the certain county, L is the L^{th} county in district m, $VMT_{L(2)}$ = the VMT in county L, $VMT_{i(2)}$ = the VMT in county i.

Or for certainty counties:

$$W_{i(2)} = 1$$

<u>Two counties randomly selected from district (j = 3)</u>
Highway District 6 only

$$W_{i(3)} = \frac{\sum_{L=1}^{11} VMT_{L(3)}}{2 \times VMT_{i(3)}} \quad \text{(Eq. 6)}$$

where L is the L^{th} county in District 6, $VMT_{L(3)}$ = the VMT in county L, $VMT_{i(3)}$ = the VMT in county i.

Finally, the statewide belt use proportion was calculated by combining the category proportions weighted by their proportion of statewide VMT:

$$p = \frac{\sum_{j=1}^{3} VMT_j p_j}{\sum_{j=1}^{3} VMT_j} \qquad \text{(Eq. 7)}$$

The result is a combination of the individual site seat belt usage rates weighted to reflect each site's importance in the total state VMT.

Estimates of subgroups of occupants, such as drivers or passengers and vehicle type (passenger car, pickup, etc.) were calculated using the same procedure.

2.6 Nonresponsive Judgement

- Based on data collection protocol and past experience, including the provision for using alternate observation sites, road segments with non-zero eligible volume and zero observations conducted should not occur. Nevertheless, if eligible vehicles passed an eligible site or an alternate eligible site during the observation time, but no usable data were collected for some reason, this site would be considered a non-responding site. The weight for a non-responding site was distributed over other sites in the same road type in the same primary sampling unit (PSU).

  Let:

  $$\pi_{gchi} = \pi_{gc}\pi_{hi|gc}$$

  be the road segment selection probability, and

  $$w_{gchi} = \frac{1}{\pi_{gchi}}$$

  be the road segment weight.

  The non-responding site nonresponse adjustment factor:

  $$f_{gch} = \frac{\sum_{all\ i} w_{gchi}}{\sum_{responding\ i} w_{gchi}}$$

  would be multiplied to all weights of non-missing road segments in the same road type of the same county, and the missing road segments would be dropped from the analysis file. However, if there were no vehicles passing the site during the selected observation time (60 minutes) this was treated as an empty block at this site. Accordingly, the site would not be considered as a non-responding site and would not require non-response adjustment.

2.7 Imputation

No imputation was done on missing data.

2.8 Standard Error Calculation

- The standard error of the overall seat belt use rate was calculated using the following procedure. Standard error of estimate values was estimated through a delete-1 jackknife approach, based on the general formula:

$$\hat{\sigma}_{\hat{p}} = [\frac{n-1}{n} \sum_{(i)=1}^{n} (\hat{p}_{(i)} - \hat{p})^2]^{1/2} \qquad \text{(Eq. 8)}$$

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 1-3; *n* = the number of sites (i.e., 150); and $\hat{p}_{(i)}$ = the estimated statewide belt use proportion with site *i* excluded from the calculation.

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

Chapter 3 Results

3.1 2023 Statewide Survey

- Table 3.1 summarizes usage rates for all front seat occupants (drivers and passengers) for the various types of highways and road classifications. The overall statewide usage rate in 2023, using the data collected at 150 sites and the described weighting procedure, was 89.40 percent.

- The true overall safety belt usage rate in Kentucky for 2023 is between 88.22 percent and 90.57 percent, with 95 percent confidence. This includes a standard error of 0.6 percent, which yields a margin of error of 1.18 percent.

- This year's data reflects a 2.68 percent increase compared to 86.72 percent last year.

- The sample size of all front seat occupants was 85,572. This is about a thirty percent larger sample size than 2021 and 2022, and is approaching the sample sizes observed in pre-pandemic safety belt surveys.

- The statewide rate for drivers was 89.4 percent while the rate for front seat passenger was 88.9 percent.

- Rates varied depending on road classification. The average usage rate was 93.7 percent on limited access (primary) roads, 88.3 percent on arterial (secondary) roads, and 84.7 percent on local (tertiary) roads.

Table 3.1 Usage Rate for Front-Seat Occupants (By Road Class)

	OCCUPANT TYPE		
ROAD CLASSIFICATION	Drivers	Passengers	All Occupants
Limited Access	94.0	92.2	93.7
Arterials	88.2	87.9	88.3
Locals	84.2	87.1	84.7
All Roads	89.4	88.9	89.4

- Appendices D and E provide summaries of the data collected (by site). For each site, the usage rate and sample size are given for all front seat occupants, drivers, and front seat passengers. The relative error and confidence interval are given for the "all front seat occupants" category. The percent unknown is given for each site. Also included are the site type (original or alternate), date observed, and site sample weight (inverse of probability of selection).

- There was a wide range of usage rates among the survey sites. The three lowest usage rates were 23.3 percent at a rural local road in Floyd County, 54.4 percent at a secondary road in Harlan County, and 69.7 percent at a local road in McCreary County. The three highest usage rates were all interstate locations in Kenton County: 98.2 percent, 97.47 percent, and 97.45 percent. The range of usage rates seen among sites has been increasing for the past several years.

- There were 76 sites that had a usage rate of 90 percent or more. This is a noticeable increase from last year when 40 sites had a usage rate of 90 percent or more.

- There were 15 sites that had a usage rate less than 80 percent.

- The highest unknown rate at any site was 9.2 percent. Of the 150 sites, 18 sites had unknown usage rates exceeding five percent. The average unknown rate from all sites is 2.1 percent.
- A substantial difference in usage rate (for all front seat occupants) was noted when vehicle type and road class were considered (see Table 3.2). The rate varied by vehicle type— from a low of 80.5 percent for pickup trucks on local roads to a high of 94.7 percent for SUVs on limited access roads.

- Examining usage rates according to road class revealed that rates ranged from 84.7 percent on local roads to 93.7 percent on limited access highways.

- Passenger cars and pickups followed the usual trend of exhibiting the lowest usage rate on local roads and the highest rate on limited access highways. Meanwhile, vans and SUVs displayed slightly higher use on local roads than arterials, although unsurprisingly the highest usage rates were still seen on limited access highways.

- For each road classification, the lowest usage rate was for pickups. However, this is the first year in the history of the survey that pickups have had a usage rate higher than 90 percent within any road class category.

Table 3.2 Usage Rate for Front-Seat Occupants (By Road Class and Vehicle Type)

	VEHICLE TYPE				
ROAD CLASSIFICATION	Passenger Car	Pickup	Van	SUV	All Vehicles
Limited Access	93.5	90.7	94.6	94.7	93.7
Arterials	88.1	83.3	89.0	90.7	88.3
Locals	82.3	80.5	88.7	89.8	84.7
All Roads	89.2	84.8	90.1	91.7	89.4

- Table 3.3 summarizes usage rate by county. The rate varied from a high of 93.5 percent in Fayette County to a low of 79.0 percent in Floyd County.

- The rate exceeded 90 percent in four counties: Fayette, Jefferson, Kenton, and Marshall.

- The three lowest usage rates were seen in Floyd County (79.0 percent), Greenup County (80.4 percent), and Harlan County (80.4 percent.) These counties are all on the eastern side of the state.

- With the redesign of 2023, most counties cannot be compared with data from last year. However, five counties were in common between the 2022 survey and this one. Of those five, four exhibited an increase in seatbelt usage.

- Beginning with the 2024 survey, it will be possible to track and compare usage rates within counties and at individual sites over five years.

Table 3.3 Usage Rate for Front-Seat Occupants (By County)

	OCCUPANT TYPE		
COUNTY	Drivers	Passengers	All Occupants
Barren	86.7	91.2	87.4
Christian	89.2	90.2	89.3
Fayette	93.5	92.8	93.5
Floyd	78.4	81.3	79.0
Franklin	93.6	92.8	93.5
Greenup	80.4	79.4	80.4
Harlan	80.4	79.4	80.4
Jefferson	90.7	89.0	90.5
Jessamine	88.5	90.2	88.8
Kenton	93.0	93.0	93.0
Larue	87.3	91.3	87.8
Marshall	90.6	90.2	90.5
McCreary	82.4	76.6	81.4
Pendleton	84.9	90.6	86.1
Wolfe	83.9	85.6	84.1
All Counties	89.4	88.9	89.4

- Usage rates by county and vehicle type are presented in Table 3.4. These rates ranged from a high of 96.8 percent for vans in Larue County to a low of 71.9 percent for pickup trucks in both Greenup County and Harlan County.

- Historically, SUVs have the highest usage rate and pickup trucks have the lowest usage rate. That is reflected in this year's survey as well: 91.7 percent of SUV occupants wore a safety belt and 84.8 percent of pickup truck occupants wore a safety belt.

- The percentage of SUV occupants using seatbelts was especially high this year. Eleven of the surveyed counties exceeded 90 percent usage in SUVs. This is a substantial increase compared to last year's survey in which only five counties had SUV rates above 90 percent.

- Similarly, vans improved from six counties reaching 90 percent last year to nine counties reaching 90 percent this year.

- The usage rate for pickup trucks was less than 80 percent in nine counties, which mirrors last year's survey. Last year, pickups had usage rates lower than 70 percent in three counties; this year no vehicles had a usage rate lower than 70 percent.

Table 3.4 Usage Rate For Front-Seat Occupants (By County And Vehicle Type)

	VEHICLE TYPE				
COUNTY	Passenger Car	Pickup	Van	SUV	All Vehicles
Barren	87.4	79.1	95.6	91.3	87.4
Christian	87.7	85.2	97.1	91.1	89.3
Fayette	92.5	90.3	93.8	95.1	93.5
Floyd	79.1	72.2	79.0	84.7	79.0
Franklin	94.4	88.5	94.9	95.0	93.5
Greenup	81.1	71.9	79.0	85.5	80.4
Harlan	81.1	71.9	79.0	85.5	80.4
Jefferson	90.3	87.0	90.8	91.9	90.5
Jessamine	88.7	79.7	85.2	93.0	88.8
Kenton	91.0	92.0	95.6	95.5	93.0
Larue	88.4	78.7	96.8	91.5	87.8
Marshall	89.6	86.8	90.8	93.3	90.5
McCreary	84.2	78.8	72.6	81.2	81.4
Pendleton	88.6	74.8	93.6	91.9	86.1
Wolfe	83.9	75.1	82.4	90.5	84.1
All Counties	89.2	84.8	90.1	91.7	89.4

3.2 Safety Belt Trends

While the data collection procedure has changed several times and redesigns occur every five years to ensure a fair sample, it is still valuable to compare the 2023 usage rate to past years. As shown in Table 3.5, statewide rates have dramatically increased from four percent in 1982 to just under 90 percent in 2018. There was a startling decrease in 2022, but 2023 illustrates a return to recent norms.

Table 3.5 Trend In Statewide Safety Belt Usage Rates (Percent Wearing Seatbelts)

YEAR	All Front Seat Occupants	Drivers	Children
1982	**	4	15
1983	**	6	24
1984	**	7	30
1985	9	9	29
1986	13	13	30
1988	20	21	48
1989	25	26	49
1990	33	32	57
1991	39	39	57
1992	40	41	62
1993	42	42	61
1994	58	58	72
1995	54	54	66
1996	55	55	79
1997	54	54	82
1998	54	54	80
1999	59	59	89
2000	60	60	87
2001	62	62	89
2002	62	62	93
2003	66	65	95
2004	66	66	96
2005	67	67	94
2006	67	68	94
2007	72	72	98
2008	73	74	98
2009	80	80	99
2010	80	81	96
2011	82	83	97
2012	84	84	98
2013	85	85	**
2014	86	87	**
2015	87	87	**
2016	87	87	**
2017	87	87	**
2018	90	90	**
2019	90	90	**
2020	90	90	**
2021	90	90	**
2022	87	86	**
2023	89	89	**

*Children under 4 years of age using either safety seat or safety belt. Children seated in front or rear seat. **Data not obtained.

- Figure 3.1 presents the preceding data in graph format. As illustrated, the increase in usage rates has slowed and remains just under 90 percent. The 2022 survey exhibited a significant decrease, but the 2023 survey results are back in line with the past several years.

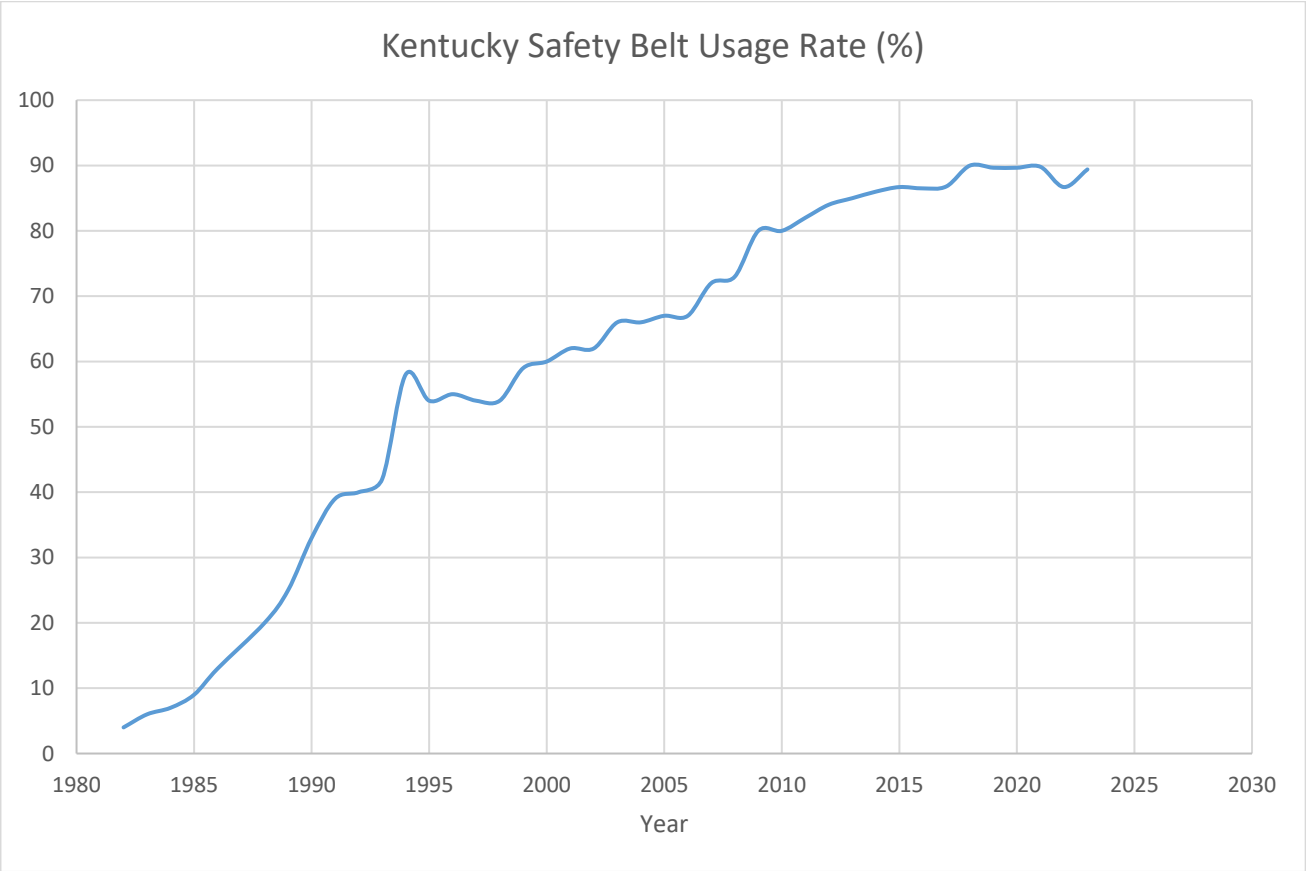


Figure 3.1 Trends in Seatbelt Usage from 1984-2023

3.3 Mini Survey

- Survey locations have often changed due to modifications of the data collection procedure and survey redesigns. In order to provide a consistent baseline by which to evaluate the data, mini-surveys have been performed in tandem with the main one. For the past several years, mini-surveys have collected data at 21 sites (selected from the 200 sites for the survey first used prior to the change in sites made in 2009). The 21 sites represented seven road functional classifications and three regions of the state.

- This mini-survey was conducted in 2023 to enable a comparison of identical sites over an extended number of years. It is especially helpful in redesign years since the regular survey sites have changed and mini-sites do not.

- The usage rate at the mini-survey locations in 2023 was 89.6 percent. This is a 1.8 percent increase from 87.8 percent in 2021, which shows consistency with the official statewide survey results.

- Compared to last year's mini-survey, usage rates increased at sixteen locations, stayed the same at three locations, and decreased at two locations.

- Figure 3.2 shows the trends in safety belt usage across the regular survey and mini-survey since it began in 2009.

- Appendix F contains the results for the mini-survey sites for the last ten years since 2013.

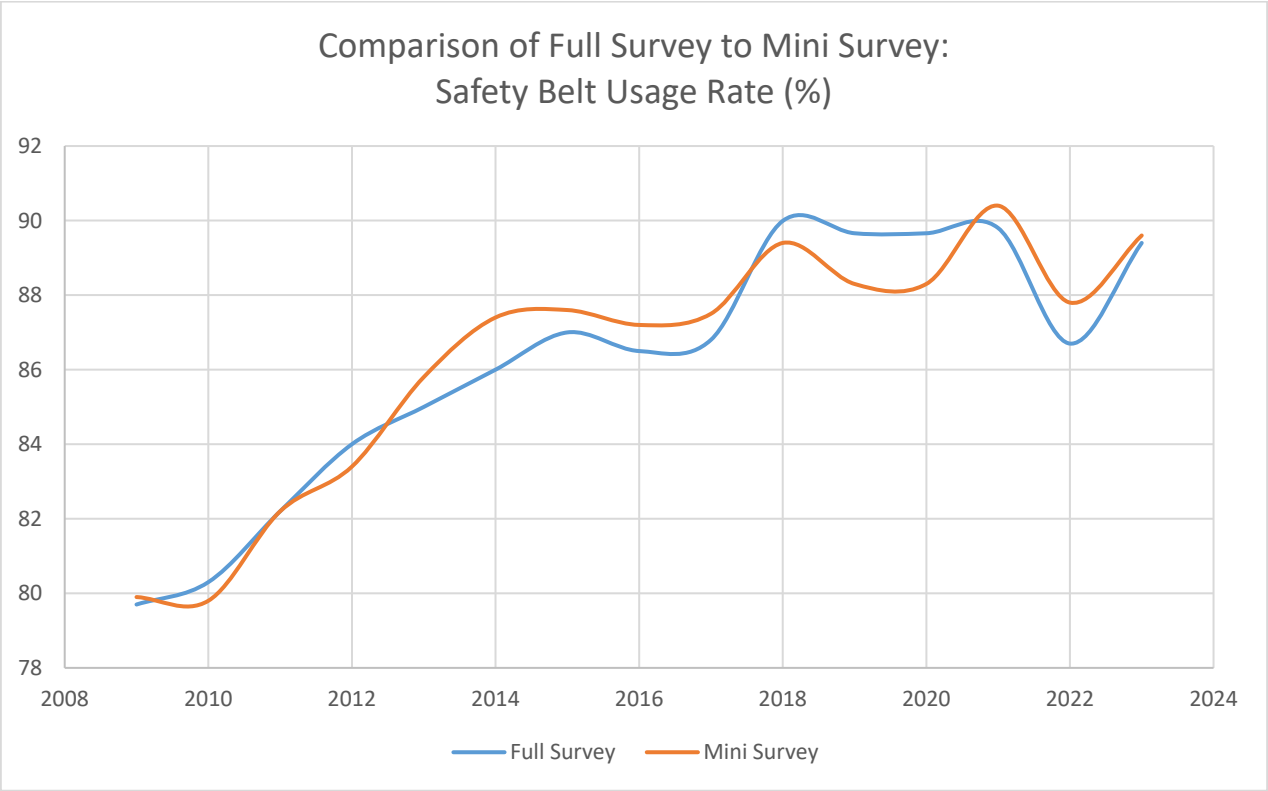


Figure 3.2 Safety Belt Usage Rates according to the Full Survey and the Mini Survey

Chapter 4 Conclusions and Recommendations

- The data show that the level of safety belt usage in 2023 (89.40 percent) increased by 2.68 percent from 2022 (86.72 percent).

- The highest usage rate since the surveys began was 89.99 percent in 2018, but the surveys illustrate a gradual flattening of the curve or “regression toward the mean.”

- A change in approach is needed if a continued rise in seatbelt usage is the state’s objective. Such changes may be focused on stronger enforcement of safety belt laws and/or increased education in targeted areas.

- Safety belt usage varies by county and vehicle type. Focusing on this variability indicates locations where more emphasis would be beneficial.

- Data shows that the lowest usage rates are for pickups. The exemption for safety belt use for occupants of farm vehicles should be changed. Education campaigns focused on pickup drivers in rural areas should be considered.

- Modifying the driver point system so that a driver receives points when they are cited for failure to use a safety belt should be considered. This could aid enforcement.

- Consideration should be given to increasing the dollar amount drivers are fined when cited for failure to wear a safety belt.

Appendix A Data Collection Sites

Table A1 Data Collection Sites

Site	District	County	Road Class	Road Surveyed	Reference	Segment VMT	County Eligible VMT	Probability of Selection
1	3	Barren	primary	I-65	Mammoth Cave Rd	146471.787	500346.058	0.219555722
2	3	Barren	primary	CUMBERLAND PARKWAY	Beckton Rd	37374.273	500346.058	0.056022635
3	3	Barren	primary	CUMBERLAND PARKWAY	Veterans Outer Loop	18494.163	500346.058	0.027722058
4	3	Barren	secondary	HAPPY VALLEY RD	Paddock Way	783.246	433439.32	0.001355287
5	3	Barren	secondary	HAPPY VALLEY RD	Buena Vista Estates	749.558	433439.32	0.001296995
6	3	Barren	secondary	N JACKSON HWY	Horton Ridge Rd	5233.371	433439.32	0.009055543
7	3	Barren	tertiary	GLENVIEW DR	Adairland Ct	702.16	357982.584	0.001471077
8	3	Barren	tertiary	PARK CITY BON AYR RD	Mayhew Rd	643.08	357982.584	0.0013473
9	3	Barren	tertiary	LOUISVILLE RD	Mammoth Cave Ave	183.414	357982.584	0.000384266
10	2	Christian	primary	I-169	Grapevine Rd	31173.084	1319052.364	0.017724704
11	2	Christian	primary	I-24	Newstead Rd	59984.506	1319052.364	0.034106591
12	2	Christian	primary	I-24	Cox Mill Rd	119400.928	1319052.364	0.067890175
13	2	Christian	primary	I-24	Millers Mill Rd	80486.924	1319052.364	0.045764061
14	2	Christian	primary	I-24	Pembroke Oak Grove Rd	14909.175	1319052.364	0.008477208
15	2	Christian	primary	I-24	Carter Rd	113754.78	1319052.364	0.064679832
16	2	Christian	secondary	COUNTRY CLUB LN	Forbes Dr	150.84	823309.554	9.16059E-05
17	2	Christian	secondary	PEMBROKE RD	Duffy St	3401.2	823309.554	0.002065566
18	2	Christian	secondary	FORT CAMPBELL BLVD	Hopkinsville Towne Center	1443	823309.554	0.000876341
19	2	Christian	secondary	CADIZ RD	Green Hill Memorial Gardens	2412.816	823309.554	0.001465315
20	2	Christian	tertiary	GLASS AVE	North Elm St	490.25	327696.214	0.000374013
21	2	Christian	tertiary	CROFTON-FRUIT HILL RD	Macedonia Loop	256.452	327696.214	0.000195648
22	7	Fayette	primary	I-64	North Cleveland Rd	215612.45	2941892.627	0.659613486
23	7	Fayette	primary	I-64	Haley Rd	70969.248	2941892.627	0.217113033
24	7	Fayette	primary	I-75	Old Richmond Rd	61019.715	2941892.627	0.186674874
25	7	Fayette	primary	I-75	US-25	15295.784	2941892.627	0.046793705
26	7	Fayette	primary	I-75	Athens Walnut Hill Rd	307393.844	2941892.627	0.940396183
27	7	Fayette	primary	I-75	Todds Rd	205546.1	2941892.627	0.628817953
28	7	Fayette	primary	I-75	Bryan Station Rd	142037.632	2941892.627	0.434529349
29	7	Fayette	primary	I-75	Georgetown Rd	86351.232	2941892.627	0.264170446
30	7	Fayette	primary	W NEW CIRCLE RD	Old Frankfort Pike	85279.6	2941892.627	0.260892051

Site	District	County	Road Class	Road Surveyed	Reference	Segment VMT	County Eligible VMT	Probability of Selection
31	7	Fayette	secondary	MAN O WAR BLVD	Buckhorn Dr	5304	3052967.619	0.015635934
32	7	Fayette	secondary	E NEW CIRCLE RD	Winchester Rd	11615.892	3052967.619	0.034243084
33	7	Fayette	secondary	NICHOLASVILLE RD	Marketplace Dr	5121.2	3052967.619	0.015097048
34	7	Fayette	secondary	NICHOLASVILLE RD	Arcadia Park	3763.8	3052967.619	0.011095499
35	7	Fayette	secondary	NICHOLASVILLE RD	Cooper Dr/Waller Ave	1698.3	3052967.619	0.005006506
36	7	Fayette	secondary	PARIS PIKE	La Troienne Way	1970.072	3052967.619	0.005807676
37	7	Fayette	secondary	VERSAILLES RD	Old Versailles Rd	14364.218	3052967.619	0.042345016
38	7	Fayette	secondary	WINCHESTER RD	Executive Dr	2566.8	3052967.619	0.007566802
39	7	Fayette	secondary	W MAIN ST	Clyde St	3062.043	3052967.619	0.009026754
40	7	Fayette	tertiary	CHINOE RD	Alumni Dr	925.708	809306.895	0.003431484
41	7	Fayette	tertiary	OLD HIGBEE MILL RD	Clemens Dr	852.048	809306.895	0.003158436
42	7	Fayette	tertiary	RUSSELL CAVE RD	Iron Works Pike	1681.01	809306.895	0.006231295
43	12	Floyd	secondary	KY-80	Maple St	4209.427	678149.371	0.00931084
44	12	Floyd	secondary	KY-80	Reynolds Ln/River Bottom Rd	1929.068	678149.371	0.00426691
45	12	Floyd	secondary	KY-80	Old Hunter Branch Rd	1867.502	678149.371	0.004130732
46	12	Floyd	secondary	US-23	Harold Church of Christ	4414.12	678149.371	0.009763601
47	12	Floyd	secondary	US-23	Rose Dr	16196.07	678149.371	0.035824121
48	12	Floyd	secondary	US-23	University Dr	4763.55	678149.371	0.010536506
49	12	Floyd	tertiary	KY-306	Lighthouse Temple Church	375.816	362910.699	0.00077667
50	12	Floyd	tertiary	KY-404	Blue River Rd	435.812	362910.699	0.00090066
51	12	Floyd	tertiary	KY-550	Old Schoolhouse Rd	805.94	362910.699	0.001665575
52	5	Franklin	primary	I-64	Hickory Ridge Rd	14144.343	577854.878	0.019581862
53	5	Franklin	primary	I-64	US-127	127148.528	577854.878	0.176028318
54	5	Franklin	primary	I-64	Hanly Ln	104512.056	577854.878	0.144689693
55	5	Franklin	primary	I-64	Duckers Rd	93474.018	577854.878	0.129408295
56	5	Franklin	secondary	EAST WEST CONNECTOR RD	Collins Ln	4953.138	686794.973	0.005769568
57	5	Franklin	secondary	EAST WEST CONNECTOR RD	Galbraith Rd	13984.722	686794.973	0.016289836
58	5	Franklin	secondary	US-127 S	Leonardwood Dr/Westridge Dr	3587	686794.973	0.004178248
59	5	Franklin	secondary	GEORGETOWN RD	Woodlake Rd	2677.128	686794.973	0.003118401
60	5	Franklin	tertiary	EVERGREEN RD	Bridgeport Christian Church	1009.47	122045.0838	0.001654258
61	9	Greenup	secondary	KY-10	East Tygarts Rd	682.52	538446.9686	0.001584464

Site	District	County	Road Class	Road Surveyed	Reference	Segment VMT	County Eligible VMT	Probability of Selection
62	9	Greenup	secondary	US-23	Ashland Dr	5489.634	538446.9686	0.012744138
63	9	Greenup	secondary	US-23	Chinns Brg	5728.89	538446.9686	0.013299569
64	9	Greenup	secondary	US-23	Grays Branch Rd	4078.62	538446.9686	0.009468481
65	9	Greenup	secondary	US-23	Antique Loop	2431.542	538446.9686	0.005644804
66	9	Greenup	tertiary	COUNTRY CLUB DR	Princess Dr	830.705	171954.4796	0.00120774
67	11	Harlan	secondary	KY-160	Red Barn Mini Market	752.402	347930.145	0.001236955
68	11	Harlan	secondary	US-119 S	Carpet Mart	6854.25	347930.145	0.011268443
69	11	Harlan	secondary	US-119 N	KY-522/Ross Dr	1226.67	347930.145	0.002016655
70	11	Harlan	secondary	US-119 N	Lakey Branch Rd	2957.084	347930.145	0.00486147
71	11	Harlan	tertiary	KY-38	Dartmont Rd	1199.156	195996.001	0.001749825
72	11	Harlan	tertiary	KY-215	Hubbard Ln	188.305	195996.001	0.000274777
73	5	Jefferson	primary	I-64	Breckenridge Ln	89372.76	9444962.556	0.123012227
74	5	Jefferson	primary	I-64	Blankenbaker Parkway	23070.8	9444962.556	0.031754536
75	5	Jefferson	primary	I-64	S. English Station Rd	104576.4	9444962.556	0.143938443
76	5	Jefferson	primary	I-65	KY-1065	87704.66	9444962.556	0.120716263
77	5	Jefferson	primary	I-65	Arthur St/E Lee St	36701.826	9444962.556	0.050516213
78	5	Jefferson	primary	I-65	E Magnolia Ave entrance ramp	44520.53	9444962.556	0.061277838
79	5	Jefferson	primary	I-71	Lime Kiln Ln	92151.954	9444962.556	0.126837496
80	5	Jefferson	primary	I-264	Brownsboro Rd	36279.225	9444962.556	0.049934547
81	5	Jefferson	primary	I-265	Smyrna Parkway	98944.674	9444962.556	0.136186963
82	5	Jefferson	primary	I-265	Pennsylvania Run Rd	89360.04	9444962.556	0.122994719
83	5	Jefferson	primary	I-265	Wolf Pen Branch Rd	13497.165	9444962.556	0.018577432
84	5	Jefferson	primary	I-265	Old Henry Rd	20356.38	9444962.556	0.028018421
85	5	Jefferson	primary	I-265	Greyling Dr	103294.08	9444962.556	0.142173464
86	5	Jefferson	secondary	TAYLORSVILLE RD	Stone Lakes Dr	1599.99	6862555.918	0.00209833
87	5	Jefferson	secondary	TAYLORSVILLE RD	Jeffersontown Christian Church	5623.538	6862555.918	0.007375072
88	5	Jefferson	secondary	WESTPORT RD	Murphy Ln	5685.594	6862555.918	0.007456456
89	5	Jefferson	secondary	S HURSTBOURNE PKWY	Watterson Trail	6452.856	6862555.918	0.008462693
90	5	Jefferson	secondary	BRECKENRIDGE LN	Dutchmans Ln	8282.91	6862555.918	0.010862744
91	5	Jefferson	secondary	SHEPHERDSVILLE RD	Rangeland Rd	10714.756	6862555.918	0.014052025
92	5	Jefferson	secondary	DIXIE HWY	Crums Ln	7701.76	6862555.918	0.010100587

Site	District	County	Road Class	Road Surveyed	Reference	Segment VMT	County Eligible VMT	Probability of Selection
93	5	Jefferson	secondary	WINKLER AVE	S Third St	878.815	6862555.918	0.001152535
94	5	Jefferson	secondary	EASTERN PKWY	Ellsworth Ave	1926.48	6862555.918	0.002526511
95	5	Jefferson	tertiary	NELSON MILLER PKY	Park View Court	542.087	1422503.821	0.000762159
96	5	Jefferson	tertiary	GOLDSMITH LN	Belmont Rd	569.669	1422503.821	0.000800938
97	7	Jessamine	secondary	WILMORE RD	April Highway	4128.574	683019.502	0.004696648
98	7	Jessamine	secondary	US-27	S Main St	6604.328	683019.502	0.007513055
99	7	Jessamine	secondary	US-27	Etter Dr	7564.377	683019.502	0.008605202
100	7	Jessamine	secondary	US-27	Arts Rental Equipment	10407.106	683019.502	0.011839078
101	7	Jessamine	secondary	LEXINGTON RD	Kohls Dr/Commerce Dr	3826.6	683019.502	0.004353123
102	7	Jessamine	secondary	N MAIN ST	Village Parkway	5916.152	683019.502	0.006730189
103	7	Jessamine	secondary	HARRODSBURG RD	Almahurst Ln/Stonegate Dr	2272.14	683019.502	0.002584777
104	7	Jessamine	tertiary	LINDEN LN	S Third St	68.15	188979.9918	8.00577E-05
105	7	Jessamine	tertiary	ASHGROVE RD	Spurlock Ln	916.12	188979.9918	0.001076191
106	6	Kenton	primary	I-75	Eads Rd	167762.672	2260467.297	0.172997322
107	6	Kenton	primary	I-75	Buttermilk Pike	15403.248	2260467.297	0.015883871
108	6	Kenton	primary	I-75	Dixie Highway	104621.125	2260467.297	0.107885588
109	6	Kenton	primary	I-75	Kyles Ln	42320.425	2260467.297	0.043640937
110	6	Kenton	primary	I-275	KY-3076	109962.039	2260467.297	0.113393152
111	6	Kenton	primary	I-275	Taylor Mill Rd	53627.312	2260467.297	0.055300629
112	6	Kenton	primary	I-275	Turkey Foot Rd	24393.81	2260467.297	0.025154963
113	6	Kenton	secondary	MADISON PIKE	Roselawn Court	3313.284	907075.2461	0.003649059
114	6	Kenton	secondary	MADISON PIKE	McCullum Pike	6816.514	907075.2461	0.007507313
115	6	Kenton	secondary	TURKEYFOOT RD	Spring Valley Dr	3810.614	907075.2461	0.004196789
116	6	Kenton	tertiary	RIVER RD	Welcome to City of Bromley sign	12653.783	550093.8887	0.015319966
117	6	Kenton	tertiary	DIXIE HWY	Bracht-Piner Rd	702.96	550093.8887	0.000851075
118	4	Larue	primary	I-65	Uptown Talley Rd	34396.383	54956.846	0.062587986
120	4	Larue	secondary	NEW JACKSON HWY	Thomas Ln	224.546	205443.751	0.000327894
121	4	Larue	secondary	NEW JACKSON HWY	Charlie Ragland Rd	3274.194	205443.751	0.004781154
122	4	Larue	secondary	LINCOLN FARM RD	Earl Jones Rd	2035.405	205443.751	0.002972208
123	4	Larue	tertiary	SONORA RD	Siberia Rd	897.768	81109.594	0.001106858
124	1	Marshall	primary	I-24	Mt Moriah Rd	144189.76	648000	0.178012049

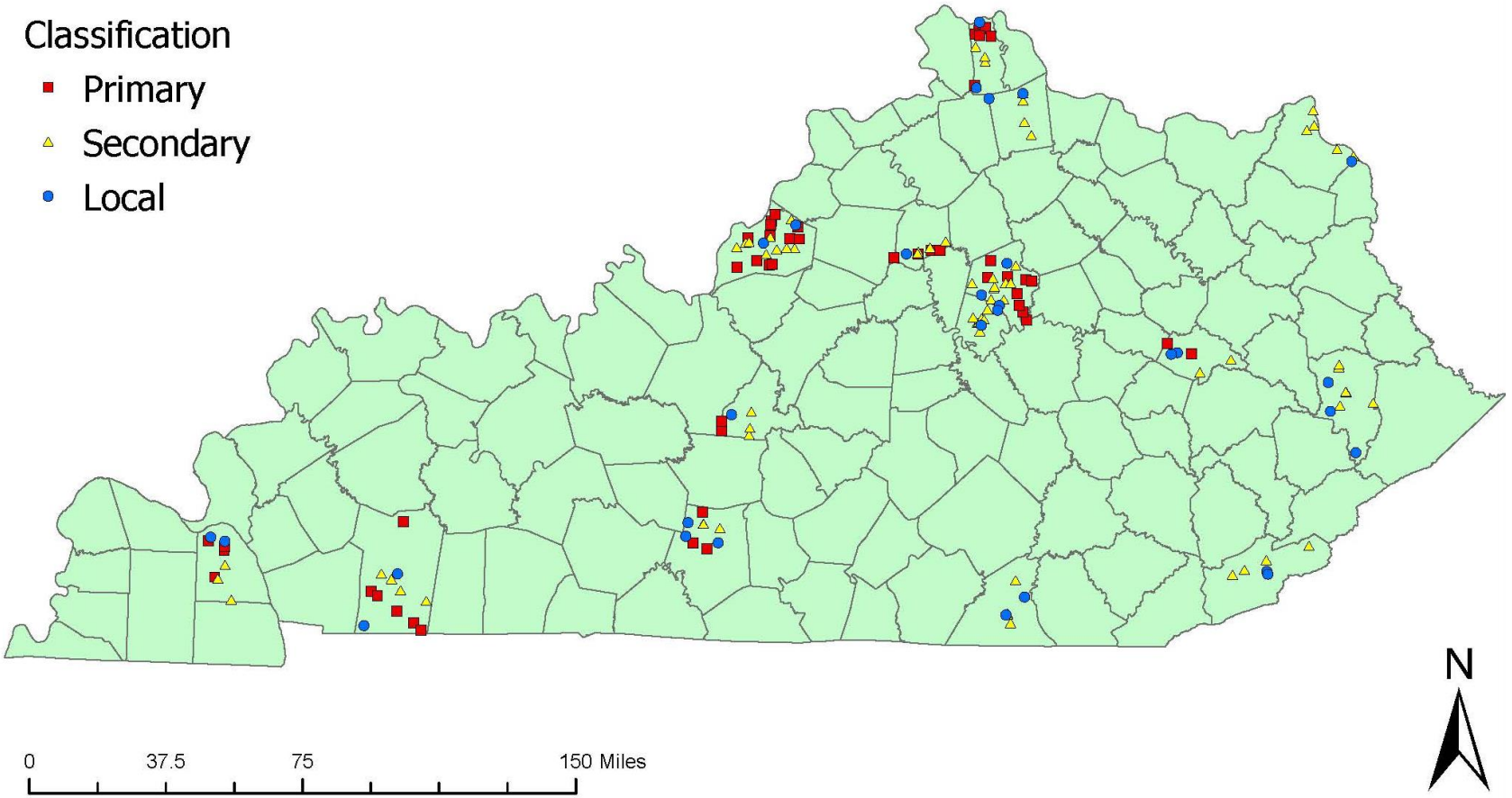
Site	District	County	Road Class	Road Surveyed	Reference	Segment VMT	County Eligible VMT	Probability of Selection
125	1	Marshall	primary	I-69	Jackson School Rd	26973.51851	648000	0.03330064
126	1	Marshall	primary	I-69	Palma Rd	32602.40653	648000	0.040249885
127	1	Marshall	primary	I-69	Lakeview Church Rd	16308.25701	648000	0.020133651
128	1	Marshall	secondary	US-641 S	Lee Brick & Block	3512.886	355043.943	0.005936537
129	1	Marshall	secondary	US-641 N	Marco St	1362.771	355043.943	0.00230299
130	1	Marshall	secondary	US-641 S	Mayfield Highway	3633.519	355043.943	0.006140399
131	1	Marshall	tertiary	OAK PARK BLVD	I-24	7771.610512	251449.6127	0.012362891
132	1	Marshall	tertiary	US-62	Holly Hills Ln/Eaves Ln	877.66	251449.6127	0.00139616
133	8	McCreary	secondary	CUMBERLAND FALLS RD	Pleasant Knob Church Rd	487.86	182092.435	0.001789698
134	8	McCreary	secondary	US-27	McCreary Reservoir	11533.104	182092.435	0.042308806
135	8	McCreary	secondary	US-27	Williamsburg St	2317.7	182092.435	0.008502405
136	8	McCreary	secondary	US-27	Cora Cooper Rd	2126.207	182092.435	0.007799919
137	8	McCreary	tertiary	KY-92	Pleasant Run Church Rd	491.732	114095.356	0.001439484
138	8	McCreary	tertiary	KY-1651	Old Bailey Rd	439.74	114095.356	0.001287284
139	6	Pendleton	secondary	US-27	Old 3L Highway	2869.44	144035.592	0.026535761
140	6	Pendleton	secondary	US-27	KY-330	194.856	144035.592	0.001801973
141	6	Pendleton	secondary	US-27	Charles Dr	2492.276	144035.592	0.023047856
142	6	Pendleton	secondary	US-27	Lock Rd	2102.386	144035.592	0.019442265
143	6	Pendleton	tertiary	KY-177	US-27	1451.99	82068.18308	0.011783194
144	6	Pendleton	tertiary	KY-491	Carters Chapel Rd	1392.752	82068.18308	0.011302466
145	10	Wolfe	primary	BTC MOUNTAIN PKWY	KY-15	8628.609	116824.579	0.029543814
146	10	Wolfe	primary	BTC MOUNTAIN PKWY	KY-746	12280.488	116824.579	0.042047617
147	10	Wolfe	secondary	KY-15	Hunting Fork Rd	5658.408	62978.809	0.035938488
148	10	Wolfe	secondary	KY-11	Bob Adams Rd	491.732	62978.809	0.001439484
149	10	Wolfe	tertiary	KY-715	Big Andy Ridge Rd	737.721	62209.36704	0.008075260
150	10	Wolfe	tertiary	KY-715	Tar Ridge Rd	1381.728	62209.36704	0.008884373

Table A2 Alternate Data Collection Sites

Site	County	Road Class	Observation Location
151	Barren	primary	I-65 @ N Toohey Ridge Road
152	Barren	secondary	Scottsville Road @ Liquor Lodge
153	Barren	tertiary	N Race St @ Clements Ave
154	Christian	primary	Pennyrile Pkwy @ Grapevine Road
155	Christian	secondary	Fort Campbell Blvd @ Legion Dr/Segler Dr
156	Christian	tertiary	Crofton-Fruit Hill Road @ Macedonia Loop
157	Fayette	primary	W New Circle Rd @ Georgetown Rd
158	Fayette	secondary	Cooper Dr @ University Dr
159	Fayette	tertiary	Chone Dr @ Alumni Dr
160	Floyd	secondary	US-23 @ service road just North of Stonewall Road
161	Floyd	tertiary	KY-122 @ 20026 KY-122
162	Franklin	primary	I-64 @ Duckers Road
163	Franklin	secondary	Lawerenceburg Rd @ Louisville Road
164	Franklin	tertiary	Cedar Road @ Hamilton Ln
165	Greenup	secondary	Industrial Parkway @ East Park Dr
166	Greenup	tertiary	KY-01 @ Hopewell Rd/Martin Rd
167	Harlan	secondary	US Highway 421 @ Chevrolet Camp Road
168	Harlan	tertiary	KY-215 @ Britton Creek Road
169	Jefferson	primary	I-65 @ Hindman Richardson connector
170	Jefferson	secondary	Bardstown Road @ Wrocklage Ave
171	Jefferson	tertiary	Cooper Chapel Road @ McNeely Lake Park North Entrance
172	Jessamine	secondary	Lexington Road @ Baker Ln/Groggins Ferry Road
173	Jessamine	tertiary	Union Mill Rd @ Service Road just past Johnson Road
174	Kenton	primary	I-275 @ Johns Hill Road
175	Kenton	secondary	Turkeyfoot Road @ Bethany Lutheran Church
176	Kenton	tertiary	Richardson Rd @ Fairway Park Apartments
177	Larue	secondary	Lincoln Parkway @ Commerce Parkway
178	Larue	tertiary	Sonora Road @ Tanner Road
179	Marshall	primary	I-24 @ KY-95
180	Marshall	secondary	US-641 S @ South Marshall Elementary School Road
181	Marshall	tertiary	Symdonia Highway @ New Harmony Road
182	McCreary	secondary	US-27 @ County Park Road
183	McCreary	tertiary	KY-92 @ Pleasant Run Church Rd
184	Pendleton	secondary	US-27 @ Wright Road/Menzie Bottoms Road
185	Pendleton	tertiary	KY-8 @ Ivor Road
186	Wolfe	primary	Bert T Combs Mountain Parkway @ Quillen Chapel Road
187	Wolfe	secondary	KY-11 @ Bob Adams Road
188	Wolfe	tertiary	KY-715 @ Big Andy Ridge Road

Appendix B Data Collection Site Map

Kentucky Seatbelt Data Collection Sites by Roadway Classification



Appendix C Data Collection Form

SAFETY BELT DATA COLLECTION FORM

Date: _____ Starting Time: _____ Ending Time: _____ Int #: _____

Location: _____ Sheet #: _____

Observer: _____ Comment: _____

DRIVER USAGE

Vehicle	Safety Belt	None	Unknown
PC			
PU			
VAN			
SUV			

FRONT-SEAT OCCUPANT USAGE (OVER 3 YEARS OF AGE)

Vehicle	Safety Belt	None	Unknown
PC			
PU			
VAN			
SUV			

Yes:

Total:

Percent usage:

Appendix D Summary of Data (by Site)

Table D1 Summary of Data

	ALL FRONT SEAT OCCUPANTS					CATEGORY			
						DRIVERS		FRONT SEAT PASSENGERS	
Site	Sample Size	Percent Usage	Relative Error (%)	Margin of Error*	Percent Unknown	Sample Size	Percent Usage	Sample Size	Percent Usage
1	612	95.6	0.9	1.6	2.5	447	95.3	165	96.4
2	322	92.9	1.5	2.8	6.9	261	92.3	61	95.1
3	247	89.1	2.2	3.9	0.8	194	90.7	53	83.0
4	244	84.0	2.8	4.6	2.4	203	83.3	41	87.8
5	289	88.2	2.1	3.7	1.4	264	87.9	25	92.0
6	165	83.0	3.5	5.7	1.2	141	80.1	24	100.0
7	173	86.1	3.1	5.2	2.3	149	85.2	24	91.7
8	85	77.6	5.8	8.9	1.2	66	77.3	19	78.9
9	78	85.9	4.6	7.7	4.9	59	83.1	19	94.7
10	308	95.5	1.2	2.3	1.9	227	96.5	81	92.6
11	594	93.4	1.1	2.0	0.8	404	93.3	190	93.7
12	903	93.0	0.9	1.7	0.4	629	93.8	274	91.2
13	814	94.1	0.9	1.6	1.2	601	94.8	213	92.0
14	982	95.5	0.7	1.3	1.4	738	95.5	244	95.5
15	962	91.5	1.0	1.8	0.4	724	92.0	238	89.9
16	285	82.8	2.7	4.4	5.3	260	83.1	25	80.0
17	147	76.9	4.5	6.8	2.6	122	73.8	25	92.0
18	297	87.5	2.2	3.8	2.6	245	85.7	52	96.2
19	147	85.7	3.4	5.7	0.7	118	84.7	29	89.7
20	142	81.7	4.0	6.4	5.3	124	82.3	18	77.8
21	59	91.5	4.0	7.1	6.3	51	92.2	8	87.5
22	1008	93.9	0.8	1.5	0.7	807	93.9	201	94.0
23	835	94.7	0.8	1.5	0.0	666	94.9	169	94.1
24	1243	94.7	0.7	1.2	0.0	974	95.6	269	91.4
25	887	93.1	0.9	1.7	0.0	679	92.9	208	93.8
26	1265	95.2	0.6	1.2	0.0	996	95.1	269	95.5
27	2202	95.2	0.5	0.9	0.0	1764	96.1	438	91.8
28	1004	96.0	0.6	1.2	0.0	816	96.6	188	93.6
29	555	96.4	0.8	1.6	0.7	472	97.5	83	90.4
30	1321	95.2	0.6	1.1	0.7	1097	94.9	224	96.9
31	1138	93.8	0.8	1.4	0.0	990	93.4	148	95.9
32	620	92.4	1.2	2.1	1.1	571	93.0	49	85.7
33	1024	95.3	0.7	1.3	0.3	931	95.3	93	95.7
34	920	94.8	0.8	1.4	0.6	814	95.5	106	89.6
35	831	93.6	0.9	1.7	0.4	720	93.2	111	96.4
36	303	90.8	1.8	3.3	2.3	260	89.2	43	100.0
37	943	94.6	0.8	1.4	1.0	841	95.0	102	91.2
38	699	90.0	1.3	2.2	1.5	652	90.5	47	83.0
39	532	92.1	1.3	2.3	1.5	471	92.6	61	88.5
40	181	88.4	2.7	4.7	3.2	161	87.6	20	95.0
41	207	94.7	1.6	3.1	0.5	181	94.5	26	96.2
42	189	85.7	3.0	5.0	2.1	148	84.5	41	90.2

Site	ALL FRONT SEAT OCCUPANTS					CATEGORY			
						DRIVERS		FRONT SEAT PASSENGERS	
	Sample Size	Percent Usage	Relative Error (%)	Margin of Error*	Percent Unknown	Sample Size	Percent Usage	Sample Size	Percent Usage
43	283	85.9	2.4	4.1	6.3	234	86.8	49	81.6
44	317	89.3	1.9	3.4	3.1	238	89.1	79	89.9
45	280	86.4	2.4	4.0	5.4	219	85.4	61	90.2
46	524	87.6	1.6	2.8	5.4	424	86.8	100	91.0
47	381	89.0	1.8	3.1	2.8	326	88.7	55	90.9
48	559	88.9	1.5	2.6	1.8	425	88.0	134	91.8
49	60	23.3	23.4	10.7	3.2	48	22.9	12	25.0
50	88	80.7	5.2	8.2	0.0	72	79.2	16	87.5
51	136	83.1	3.9	6.3	0.0	113	82.3	23	87.0
52	1322	96.4	0.5	1.0	0.5	901	95.9	421	97.4
53	920	94.5	0.8	1.5	0.8	742	94.5	178	94.4
54	990	95.5	0.7	1.3	0.0	813	95.8	177	93.8
55	860	94.8	0.8	1.5	0.0	682	95.0	178	93.8
56	439	91.1	1.5	2.7	4.4	366	90.7	73	93.2
57	485	92.6	1.3	2.3	0.6	419	93.1	66	89.4
58	711	93.0	1.0	1.9	0.6	635	93.7	76	86.8
59	236	91.5	2.0	3.6	5.2	191	91.1	45	93.3
60	96	93.8	2.6	4.8	5.0	75	93.3	21	95.2
61	97	76.3	5.7	8.5	8.5	73	74.0	24	83.3
62	485	84.1	2.0	3.3	2.4	405	87.4	80	67.5
63	363	85.1	2.2	3.7	3.7	318	86.8	45	73.3
64	294	87.1	2.2	3.8	2.3	251	86.5	43	90.7
65	164	84.1	3.4	5.6	8.9	136	84.6	28	82.1
66	177	84.7	3.2	5.3	4.8	157	84.7	20	85.0
67	125	54.4	8.2	8.7	4.6	106	55.7	19	47.4
68	158	81.0	3.9	6.1	4.2	136	79.4	22	90.9
69	204	76.5	3.9	5.8	4.7	171	76.0	33	78.8
70	108	86.1	3.9	6.5	3.6	85	87.1	23	82.6
71	105	86.7	3.8	6.5	8.7	79	84.8	26	92.3
72	132	78.8	4.5	7.0	6.4	93	78.5	39	79.5
73	1787	95.6	0.5	1.0	0.2	1593	96.0	194	91.8
74	1119	93.7	0.8	1.4	1.9	885	94.0	234	92.7
75	1101	93.6	0.8	1.5	0.0	829	94.1	272	91.9
76	1713	94.5	0.6	1.1	0.2	1372	95.3	341	91.2
77	1399	95.1	0.6	1.1	0.0	1368	95.0	31	96.8
78	72	75.0	6.8	10.0	0.0	64	76.6	8	62.5
79	1422	95.5	0.6	1.1	0.5	1085	95.7	337	95.0
80	1431	96.1	0.5	1.0	0.1	1193	96.1	238	96.2
81	1277	93.3	0.7	1.4	0.5	1031	93.4	246	93.1
82	968	91.3	1.0	1.8	0.0	820	91.2	148	91.9
83	907	95.5	0.7	1.4	0.7	748	95.6	159	95.0
84	1869	94.9	0.5	1.0	0.0	1559	95.1	310	93.5

Site	ALL FRONT SEAT OCCUPANTS					CATEGORY			
						DRIVERS		FRONT SEAT PASSENGERS	
	Sample Size	Percent Usage	Relative Error (%)	Margin of Error*	Percent Unknown	Sample Size	Percent Usage	Sample Size	Percent Usage
85	990	91.9	0.9	1.7	0.8	788	92.1	202	91.1
86	702	90.2	1.2	2.2	1.5	620	90.5	82	87.8
87	450	89.8	1.6	2.8	0.0	404	90.3	46	84.8
88	691	90.6	1.2	2.2	0.1	610	90.3	81	92.6
89	482	89.8	1.5	2.7	0.8	431	91.0	51	80.4
90	1280	93.3	0.8	1.4	0.5	1160	93.5	120	90.8
91	448	80.6	2.3	3.7	0.0	415	80.7	33	78.8
92	615	80.2	2.0	3.2	1.8	519	79.6	96	83.3
93	315	86.7	2.2	3.8	0.0	298	86.9	17	82.4
94	404	87.9	1.8	3.2	1.0	351	87.2	53	92.5
95	281	89.7	2.0	3.6	4.4	252	88.9	29	96.6
96	381	89.2	1.8	3.1	0.0	342	89.8	39	84.6
97	400	82.5	2.3	3.7	3.1	338	82.0	62	85.5
98	529	92.2	1.3	2.3	2.2	437	92.0	92	93.5
99	851	89.8	1.2	2.0	1.0	738	90.0	113	88.5
100	567	91.4	1.3	2.3	2.4	479	91.0	88	93.2
101	709	92.2	1.1	2.0	1.9	604	92.2	105	92.4
102	693	90.6	1.2	2.2	1.4	582	89.7	111	95.5
103	337	90.2	1.8	3.2	0.6	274	89.8	63	92.1
104	90	83.3	4.7	7.7	0.0	77	83.1	13	84.6
105	88	86.4	4.2	7.2	3.3	73	86.3	15	86.7
106	1224	97.5	0.5	0.9	0.9	1017	97.5	207	97.1
107	1578	98.2	0.3	0.7	0.3	1387	98.6	191	95.8
108	1684	94.0	0.6	1.1	0.4	1251	93.7	433	94.9
109	1687	97.5	0.4	0.8	0.1	1447	98.0	240	94.2
110	1092	94.5	0.7	1.4	0.6	912	95.1	180	91.7
111	1421	94.2	0.7	1.2	0.2	1169	94.1	252	94.4
112	1333	96.6	0.5	1.0	0.4	1134	96.6	199	96.5
113	266	94.0	1.6	2.9	2.9	249	94.0	17	94.1
114	307	90.6	1.8	3.3	4.4	268	90.7	39	89.7
115	567	89.9	1.4	2.5	1.7	489	90.0	78	89.7
116	50	78.0	7.5	11.5	0.0	41	75.6	9	88.9
117	339	87.9	2.0	3.5	2.9	284	88.0	55	87.3
118	921	95.2	0.7	1.4	0.8	649	95.2	272	95.2
119	908	93.6	0.9	1.6	0.5	630	93.8	278	93.2
120	63	84.1	5.5	9.0	1.6	52	82.7	11	90.9
121	111	81.1	4.6	7.3	4.3	101	81.2	10	80.0
122	297	84.8	2.5	4.1	2.3	241	84.6	56	85.7
123	77	85.7	4.7	7.8	3.8	70	84.3	7	100.0
124	983	96.1	0.6	1.2	0.0	717	96.1	266	96.2
125	159	93.7	2.1	3.8	1.9	123	93.5	36	94.4
126	521	92.5	1.2	2.3	1.1	405	93.1	116	90.5
127	502	91.6	1.3	2.4	0.0	376	92.6	126	88.9

	ALL FRONT SEAT OCCUPANTS					CATEGORY			
						DRIVERS		FRONT SEAT PASSENGERS	
Site	Sample Size	Percent Usage	Relative Error (%)	Margin of Error*	Percent Unknown	Sample Size	Percent Usage	Sample Size	Percent Usage
128	286	91.6	1.8	3.2	5.6	245	91.0	41	95.1
129	347	88.2	2.0	3.4	6.0	299	88.3	48	87.5
130	345	92.2	1.6	2.8	2.3	293	92.8	52	88.5
131	156	87.8	3.0	5.1	5.5	135	86.7	21	95.2
132	140	77.1	4.6	7.0	3.4	129	77.5	11	72.7
133	99	81.8	4.7	7.6	4.8	71	81.7	28	82.1
134	327	89.0	1.9	3.4	1.5	252	88.5	75	90.7
135	397	84.9	2.1	3.5	1.5	311	83.9	86	88.4
136	467	83.7	2.0	3.3	0.0	365	86.0	102	75.5
137	165	81.8	3.7	5.9	0.0	132	84.1	33	72.7
138	142	69.7	5.5	7.6	2.1	119	72.3	23	56.5
139	129	85.3	3.7	6.1	0.8	99	82.8	30	93.3
140	207	91.3	2.1	3.8	2.8	169	91.1	38	92.1
141	196	92.3	2.1	3.7	8.4	150	92.7	46	91.3
142	434	91.9	1.4	2.6	2.9	336	90.5	98	96.9
143	250	86.0	2.6	4.3	4.2	192	85.4	58	87.9
144	64	71.9	7.8	11.0	0.0	52	69.2	12	83.3
145	306	87.9	2.1	3.7	0.3	211	88.2	95	87.4
146	154	89.6	2.7	4.8	0.6	105	93.3	49	81.6
147	175	78.3	4.0	6.1	0.0	137	78.1	38	78.9
148	228	87.3	2.5	4.3	9.2	170	84.7	58	94.8
149	103	75.7	5.6	8.3	3.7	75	73.3	28	82.1
150	159	78.0	4.2	6.4	6.5	118	73.7	41	90.2

*Percent (using .95 probability)

Appendix E Summary of Data (With Sample Weights)

Table E1 Summary of Data (With Sample Weights)

Site ID	Site Type	Date Observed	Site Sample Weight	Number of Drivers	Number of Front Passengers	Number of Occupants Belted	Number of Occupants Unbelted	Number of Occupants with Unknown Belt Use
1	Original	7/18/2023	4.555	463	165	585	27	16
2	Original	7/18/2023	17.850	284	62	299	23	24
3	Original	6/27/2023	36.072	196	53	220	27	2
4	Original	6/27/2023	737.851	209	41	205	39	6
5	Original	6/8/2023	771.013	268	25	255	34	4
6	Original	6/27/2023	110.430	143	24	137	28	2
7	Original	6/8/2023	679.774	153	24	149	24	4
8	Original	6/8/2023	742.225	67	19	66	19	1
9	Original	7/18/2023	2602.365	61	21	67	11	4
10	Original	6/14/2023	56.418	231	83	294	14	6
11	Original	7/11/2023	29.320	409	190	555	39	5
12	Original	6/26/2023	14.730	632	275	840	63	4
13	Original	7/17/2023	21.851	611	213	766	48	10
14	Original	6/22/2023	117.963	752	244	938	44	14
15	Original	8/1/2023	15.461	728	238	880	82	4
16	Original	8/10/2023	10916.329	276	25	236	49	16
17	Original	8/1/2023	484.129	126	25	113	34	4
18	Original	6/22/2023	1141.108	253	52	260	37	8
19	Original	7/11/2023	682.447	119	29	126	21	1
20	Original	6/14/2023	2673.707	132	18	116	26	8
21	Alternate	8/10/2023	5111.229	55	8	54	5	4
22	Original	6/29/2023	1.516	814	201	947	61	7
23	Original	6/26/2023	4.606	666	169	791	44	0
24	Original	6/28/2023	5.357	974	269	1177	66	0
25	Original	7/19/2023	21.370	679	208	826	61	0
26	Original	6/26/2023	1.063	996	269	1204	61	0
27	Original	7/3/2023	1.590	1765	438	2097	105	1
28	Original	6/29/2023	2.301	816	188	964	40	0
29	Original	6/29/2023	3.785	476	83	535	20	4
30	Original	6/5/2023	3.833	1106	224	1258	63	9

Site ID	Site Type	Date Observed	Site Sample Weight	Number of Drivers	Number of Front Passengers	Number of Occupants Belted	Number of Occupants Unbelted	Number of Occupants with Unknown Belt Use
31	Original	7/3/2023	63.955	990	148	1067	71	0
32	Original	6/26/2023	29.203	578	49	573	47	7
33	Original	7/3/2023	66.238	934	93	976	48	3
34	Original	6/5/2023	90.127	819	107	872	48	6
35	Original	6/29/2023	199.740	723	111	778	53	3
36	Original	7/21/2023	172.186	267	43	275	28	7
37	Original	6/5/2023	23.616	850	103	892	51	10
38	Original	6/26/2023	132.156	663	47	629	70	11
39	Original	6/5/2023	110.782	477	63	490	42	8
40	Alternate	7/21/2023	291.419	167	20	160	21	6
41	Original	6/5/2023	316.612	182	26	196	11	1
42	Original	7/21/2023	160.480	152	41	162	27	4
43	Original	7/24/2023	107.402	253	49	243	40	19
44	Original	6/20/2023	234.362	248	79	283	34	10
45	Original	7/10/2023	242.088	233	63	242	38	16
46	Original	6/20/2023	102.421	452	102	459	65	30
47	Original	6/20/2023	27.914	336	56	339	42	11
48	Original	7/10/2023	94.908	434	135	497	62	10
49	Original	7/24/2023	1287.547	50	12	14	46	2
50	Original	6/13/2023	1110.297	72	16	71	17	0
51	Original	6/13/2023	600.393	113	23	113	23	0
52	Original	6/9/2023	51.068	908	421	1274	48	7
53	Original	7/12/2023	5.681	749	178	869	51	7
54	Original	8/8/2023	6.911	813	177	945	45	0
55	Original	7/12/2023	7.727	682	178	815	45	0
56	Original	7/13/2023	173.323	384	75	400	39	20
57	Original	8/8/2023	61.388	422	66	449	36	3
58	Original	8/8/2023	239.335	639	76	661	50	4
59	Original	7/13/2023	320.677	203	46	216	20	13
60	Original	7/13/2023	604.501	80	21	90	6	5
61	Original	7/7/2023	631.128	82	24	74	23	9

Site ID	Site Type	Date Observed	Site Sample Weight	Number of Drivers	Number of Front Passengers	Number of Occupants Belted	Number of Occupants Unbelted	Number of Occupants with Unknown Belt Use
62	Original	6/20/2023	78.467	417	80	408	77	12
63	Original	6/20/2023	75.190	332	45	309	54	14
64	Original	7/7/2023	105.614	258	43	256	38	7
65	Original	7/7/2023	177.154	152	28	138	26	16
66	Original	6/20/2023	827.993	166	20	150	27	9
67	Original	8/2/2023	808.437	112	19	68	57	6
68	Original	6/6/2023	88.743	142	23	128	30	7
69	Original	8/2/2023	495.871	181	33	156	48	10
70	Original	6/6/2023	205.699	89	23	93	15	4
71	Original	7/11/2023	571.486	88	27	91	14	10
72	Original	7/11/2023	3639.312	101	40	104	28	9
73	Original	7/20/2023	8.129	1597	194	1708	79	4
74	Original	6/21/2023	31.492	905	236	1049	70	22
75	Original	7/13/2023	6.947	829	272	1030	71	0
76	Original	6/12/2023	8.284	1375	341	1618	95	3
77	Original	7/5/2023	19.796	1368	31	1330	69	0
78	Original	7/13/2023	16.319	64	8	54	18	0
79	Original	6/23/2023	7.884	1091	338	1358	64	7
80	Original	6/23/2023	20.026	1194	238	1375	56	1
81	Original	6/16/2023	7.343	1037	247	1192	85	7
82	Original	7/31/2023	8.130	820	148	884	84	0
83	Original	6/23/2023	53.829	754	159	866	41	6
84	Original	6/23/2023	35.691	1559	310	1773	96	0
85	Original	6/12/2023	7.034	796	202	910	80	8
86	Original	6/16/2023	476.569	631	82	633	69	11
87	Original	7/13/2023	135.592	404	46	404	46	0
88	Original	6/23/2023	134.112	611	81	626	65	1
89	Original	6/23/2023	118.166	435	51	433	49	4
90	Original	7/20/2023	92.058	1166	120	1194	86	6
91	Original	7/31/2023	71.164	415	33	361	87	0
92	Original	6/12/2023	99.004	530	96	493	122	11

Site ID	Site Type	Date Observed	Site Sample Weight	Number of Drivers	Number of Front Passengers	Number of Occupants Belted	Number of Occupants Unbelted	Number of Occupants with Unknown Belt Use
93	Original	7/5/2023	867.653	298	17	273	42	0
94	Original	6/16/2023	395.803	354	54	355	49	4
95	Original	6/21/2023	1312.062	265	29	252	29	13
96	Original	7/5/2023	1248.535	342	39	340	41	0
97	Original	7/21/2023	212.918	351	62	330	70	13
98	Original	7/3/2023	133.102	448	93	488	41	12
99	Original	7/21/2023	116.209	747	113	764	87	9
100	Original	7/3/2023	84.466	493	88	518	49	14
101	Original	7/3/2023	229.720	617	106	654	55	14
102	Original	7/3/2023	148.584	592	111	628	65	10
103	Original	7/21/2023	386.881	276	63	304	33	2
104	Original	6/5/2023	12490.994	77	13	75	15	0
105	Original	6/5/2023	929.203	76	15	76	12	3
106	Original	7/20/2023	5.780	1028	207	1193	31	11
107	Original	6/13/2023	62.957	1392	191	1550	28	5
108	Original	7/14/2023	9.269	1258	433	1583	101	7
109	Original	6/13/2023	22.914	1448	240	1644	43	1
110	Original	7/14/2023	8.819	919	180	1032	60	7
111	Alternate	7/14/2023	18.083	1172	252	1338	83	3
112	Original	6/13/2023	39.754	1140	199	1288	45	6
113	Original	6/13/2023	274.043	257	17	250	16	8
114	Original	8/3/2023	133.203	281	40	278	29	14
115	Original	7/14/2023	238.277	499	78	510	57	10
116	Original	7/20/2023	65.274	41	9	39	11	0
117	Original	6/22/2023	1174.984	294	55	298	41	10
118	Original	6/21/2023	15.978	656	272	877	44	7
119	Original	8/2/2023	10.000	634	279	850	58	5
120	Original	6/21/2023	3049.765	53	11	53	10	1
121	Original	7/10/2023	209.155	106	10	90	21	5
122	Original	6/9/2023	336.450	247	57	252	45	7
123	Original	7/10/2023	903.458	73	7	66	11	3

Site ID	Site Type	Date Observed	Site Sample Weight	Number of Drivers	Number of Front Passengers	Number of Occupants Belted	Number of Occupants Unbelted	Number of Occupants with Unknown Belt Use
124	Original	6/14/2023	5.618	717	266	945	38	0
125	Original	6/28/2023	30.029	126	36	149	10	3
126	Original	6/28/2023	24.845	411	116	482	39	6
127	Original	6/14/2023	49.668	376	126	460	42	0
128	Original	8/1/2023	168.448	261	42	262	24	17
129	Original	8/1/2023	434.218	321	48	306	41	22
130	Original	6/28/2023	162.856	301	52	318	27	8
131	Original	7/6/2023	80.887	144	21	137	19	9
132	Original	7/7/2023	716.250	134	11	108	32	5
133	Original	6/27/2023	558.753	75	29	81	18	5
134	Original	6/8/2023	23.636	257	75	291	36	5
135	Original	7/5/2023	117.614	317	86	337	60	6
136	Original	6/8/2023	128.206	365	102	391	76	0
137	Alternate	8/4/2023	694.693	132	33	135	30	0
138	Original	7/5/2023	776.829	122	23	99	43	3
139	Original	7/12/2023	37.685	100	30	110	19	1
140	Original	6/12/2023	554.947	174	39	189	18	6
141	Original	7/7/2023	43.388	164	50	181	15	18
142	Original	7/7/2023	51.434	348	99	399	35	13
143	Original	7/7/2023	84.867	202	59	215	35	11
144	Original	6/22/2023	88.476	52	12	46	18	0
145	Original	6/29/2023	33.848	212	95	269	37	1
146	Original	6/29/2023	23.783	106	49	138	16	1
147	Original	8/2/2023	27.825	137	38	137	38	0
148	Alternate	8/2/2023	694.693	192	59	199	29	23
149	Alternate	8/2/2023	123.835	79	28	78	25	4
150	Original	6/16/2023	112.557	128	42	124	35	11
			Totals	**70421**	**15151**	**78110**	**6485**	**977**

Appendix F Mini Survey Data

Table F1 Data from Mini Survey

County	Town	Intersection Description	2013	2014	2015	2016	2017	2018	2019	2021	2022	2023
Barren	Cave City	I-65 at Exit 53	91	89	91	90	88	96	91	96	95	95
Meade	Muldraugh	US 31W at KY 1638	88	88	89	88	88	91	88	90	86	90
Grayson	Leitchfield	KY 259 at US 62	84	85	85	79	85	85	87	85	82	85
Logan	Russellville	US 68 at US 79	84	83	82	86	83	83	87	88	77	81
Hopkins	Madisonville	Pennyrile Pkwy at Exit 44	87	91	91	95	91	93	91	94	87	90
Henderson	Henderson	Us 41A at 5th St.	85	85	88	80	88	90	90	90	87	89
Calloway	Murray	KY 1637 at 16th	82	85	88	88	85	90	89	91	91	92
Shelby	Simpsonville	I-64 at Exit 28	88	93	95	94	93	97	93	95	92	95
Woodford	Versailles	US 60 at US 62	94	93	89	93	88	94	90	87	91	92
Oldham	La Grange	KY 146 at KY 329B	88	90	92	92	94	91	91	94	92	90
Franklin	Frankfort	KY 2820 at US 127	87	87	79	73	84	74	83	86	86	90
Kenton	Crescent Springs	I-75 at Exit 186	91	92	92	93	93	95	89	94	94	96
Jefferson	Louisville	US 31W at KY 841	85	87	87	84	88	86	86	86	82	82
Boone	Walton	US 42 at US 25	86	87	88	91	88	88	89	94	92	91
Boyd	Ashland	I-64 at Exit 185	84	90	91	85	88	91	91	87	89	91
Lincoln	Stanford	US 27 at US 150	86	86	82	87	82	88	86	87	83	85
Carter	Grayson	US 60 at KY 7	80	81	81	80	83	84	87	88	85	89
Floyd	Drift	KY 680 at KY 122	70	71	68	63	66	66	74	85	76	81
Rowan	Morehead	I-64 at Exit 137	84	89	89	83	92	95	90	93	87	89
Laurel	Corbin	US 25E at US 25	79	81	85	82	83	83	92	92	85	85
Pulaski	Somerset	KY 80 at KY 2296	79	81	85	88	84	90	84	89	84	88
Statewide Usage			**85.8**	**87.4**	**87.6**	**87.2**	**87.5**	**89.4**	**88.3**	**90.4**	**87.8**	**89.6**

Appendix G R Code for County and Site Selection

```
library(factoextra)
library(nilde)
library(tigris)
library(ggplot2)

setwd("/Users/derekyoung/Documents/Safety Belt Survey/FY22 Report/FY22 Updated (Revised)/")

VMT <- read.table("VMT_16_20.txt",header=T)
VMT <- VMT[order(VMT$Total,decreasing=T),]
VMT[,"VMT20"] <- VMT$DailyVMT*366
VMT[,"cumper"] <- cumsum(VMT$Total)/sum(VMT$Total)
cutoff <- min(which(VMT$cumper>=0.85))

Stage1 <- VMT[1:cutoff,]

Stage2 <- lapply(1:12, function(i) Stage1[which(Stage1$District==i),1])
names(Stage2) <- 1:12
Stage2[[5]] <- Stage2[[5]][-which(Stage2[[5]]=="Jefferson")]
Stage2[[7]] <- Stage2[[7]][-which(Stage2[[7]]=="Fayette")]

set.seed(10)
sample.23 <- c("Jefferson","Fayette",unlist(sapply(1:12,function(i) sample(Stage2[[i]],size=ifelse(i==6,2,1)))))

Stage3 <- Stage1[VMT$County%in%sample.23,]

Stage3 <- Stage3[order(Stage3$VMT20),]

#3-5 Clusters looks appropriate
fviz_nbclust(data.frame(Stage3$VMT20), kmeans, method = "wss",k.max=8)
fviz_nbclust(data.frame(Stage3$VMT20), kmeans, method = "gap",nboot=500,k.max=8)
VMT_cluster <- kmeans(Stage3$VMT20,centers=5,iter.max=100,nstart=200)$cluster
levs <- unique(VMT_cluster)
VMT_class <- unlist(sapply(1:length(levs),function(i) rep(i,length(which(VMT_cluster==levs[i])))))
Stage3[,"VMT_class"] <- VMT_class

site.selection <- as.numeric(table(VMT_class))
de.out <- nilde(a=site.selection,n=150)
de.out.cand <- de.out$solutions[,which(apply(de.out$solutions==0,2,sum)==0)]*site.selection

#150 sites divided by 5 clusters means we should have roughly 20-30 sites per cluster
de.out.cand <- de.out.cand[,which(apply(de.out.cand,2,min)>=20)]
de.out.cand <- de.out.cand[,sapply(1:ncol(de.out.cand), function(i) all(mod(de.out.cand[,i],3)==0))]

#We can then look for a solution where the number of sites per county increases with the cluster
site.cand <- t(de.out.cand/site.selection)
site.inc.ind <- sapply(1:nrow(site.cand),function(i) all(sort(site.cand[i,])==site.cand[i,]))
site.cand <- site.cand[site.inc.ind,]
site.cand <- site.cand[sapply(1:nrow(site.cand), function(i) all(mod(site.cand[i,],3)==0)),]

#Solution 297600 looks good
number.sites <- data.frame(de.out.cand/site.selection)[,"sol.297600"]
Stage3[,"no.sites"] <- rep(number.sites,site.selection)

#County selection map
ky <- counties(state = "KY")
ind <- ky$NAME%in%Stage3$County
col.fill <- rep("white",120)
col.fill[ind] <- "red"

ggplot() + geom_sf(data = ky, color="black", fill=col.fill, size=0.25) +
ggtitle("County Selection Map")
```

```
#Site selection process
setwd("/Users/derekyoung/Documents/Safety Belt Survey/FY22 Report/Road Segments (Revised)/")

file.loc <- "FINAL_Road_Segments_2023_counties_Second_Submittal.xlsx"
Barren <- read_excel(file.loc, sheet = "Barren")
Christian <- read_excel(file.loc, sheet = "Christian")
Fayette <- read_excel(file.loc, sheet = "Fayette")
Floyd <- read_excel(file.loc, sheet = "Floyd")
Franklin <- read_excel(file.loc, sheet = "Franklin")
Greenup <- read_excel(file.loc, sheet = "Greenup")
Harlan <- read_excel(file.loc, sheet = "Harlan")
Jefferson <- read_excel(file.loc, sheet = "Jefferson")
Jessamine <- read_excel(file.loc, sheet = "Jessamine")
Kenton <- read_excel(file.loc, sheet = "Kenton")
Larue <- read_excel(file.loc, sheet = "Larue")
Marshall <- read_excel(file.loc, sheet = "Marshall")
McCreary <- read_excel(file.loc, sheet = "McCreary")
Pendleton <- read_excel(file.loc, sheet = "Pendleton")
Wolfe <- read_excel(file.loc, sheet = "Wolfe")

#Function to apply to each county
roadsel.fn <- function(county,sites){
 county <- data.frame(county)
 total.VMT <- sum(county$DVMT)
 county$ROAD_CLASS <- as.factor(county$ROAD_CLASS)
 road.levels <- levels(county$ROAD_CLASS)
 county <- lapply(1:length(road.levels), function(i) county[county$ROAD_CLASS == road.levels[i],])
 names(county) <- road.levels
 road.levels.VMT <- sapply(1:length(county), function(i) sum(county[[i]]$DVMT))
 road.level.POS <- road.levels.VMT/total.VMT
 sites.class <- round(sites*road.level.POS)
 if(sum(sites.class)>sites) sites.class[which.max(sites.class)] <- sites.class[which.max(sites.class)]-1
 if(sum(sites.class)<sites) sites.class[which.min(sites.class)] <- sites.class[which.min(sites.class)]+1
 POS <- vector("list",length(county))
 for(i in 1:length(POS)){
  POS[[i]] <- county[[i]]$DVMT/sum(county[[i]]$DVMT)
  county[[i]] <- cbind(county[[i]],POS=POS[[i]]*sites.class[i])
 }
 roadsel <- lapply(1:length(county),function(i) county[[i]][sample(1:nrow(county[[i]]),replace=FALSE,size=sites.class[i],prob=POS[[i]]),] )
 all.roadsel <- NULL
 for(i in 1:length(roadsel)) all.roadsel <- rbind(all.roadsel,roadsel[[i]])
 all.roadsel
}

#Actual selection, followed by outputting it to Excel
set.seed(1)
Barren_Road <- roadsel.fn(Barren,sites=9)
Christian_Road <- roadsel.fn(Christian,sites=12)
Fayette_Road <- roadsel.fn(Fayette,sites=21)
Floyd_Road <- roadsel.fn(Floyd,sites=9)
Franklin_Road <- roadsel.fn(Franklin,sites=9)
Greenup_Road <- roadsel.fn(Greenup,sites=6)
Harlan_Road <- roadsel.fn(Harlan,sites=6)
Jefferson_Road <- roadsel.fn(Jefferson,sites=24)
Jessamine_Road <- roadsel.fn(Jessamine,sites=9)
Kenton_Road <- roadsel.fn(Kenton,sites=12)
Larue_Road <- roadsel.fn(Larue,sites=6)
Marshall_Road <- roadsel.fn(Marshall,sites=9)
McCreary_Road <- roadsel.fn(McCreary,sites=6)
Pendleton_Road <- roadsel.fn(Pendleton,sites=6)
Wolfe_Road <- roadsel.fn(Wolfe,sites=6)

out <- rbind(Barren_Road, Christian_Road, Fayette_Road, Floyd_Road, Franklin_Road,
        Greenup_Road, Harlan_Road, Jefferson_Road, Jessamine_Road, Kenton_Road,
        Larue_Road, Marshall_Road, McCreary_Road, Pendleton_Road, Wolfe_Road)
write_xlsx(out,"Road_Selections.xlsx")
```