2024
Maryland Seat Belt Usage Report
NHTSA Jurisdictions

THIS REPORT WAS PREPARED IN COOPERATION WITH THE
Maryland Department of Transportation
Highway Safety Office
And
U.S. Department of Transportation
National Highway Traffic Safety Administration

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EXECUTIVE SUMMARY

The National Study Center for Trauma and EMS at the University of Maryland, Baltimore conducted a comprehensive study of seat belt usage in the State of Maryland in June 2024. Seat belt usage data were collected on drivers and front seat outboard passengers observed in a total of 29,850 vehicles at 140 randomly selected sites located within 14 jurisdictions of the State. Observed vehicles included passenger cars, vans, sport utility vehicles (SUV), pick-up trucks, and other vehicles below 10,000 pounds of gross vehicle weight. Data were collected on occupants of vehicles traveling on Primary (interstate roadways), Secondary (arterial roadways), and Local roads.

Overall usage rate and standard error (SE) results of the Statewide study, following weighted adjustment by probability of road segment selection and proportion of jurisdiction-level vehicle miles traveled (VMT) and exclusion of unknown observations, were as follows:

Roadways	All Vehicles				Passenger Cars/SUVs				Pick-up Trucks		
	Number of Occupants	Usage Rate (%)	SE* (%)		Number of Occupants	Usage Rate (%)	SE (%)		Number of Occupants	Usage Rate (%)	SE (%)
All Roadways	32,593	90.6	0.9		28,407	91.7	0.8		4,186	82.6	2.2
Primary Roads	13,824	91.3	1.0		12,279	92.5	0.9		1,545	79.3	3.0
Secondary Roads	17,430	90.8	0.9		14,900	91.6	0.9		2,530	86.7	1.9
Local Roads**	1,339	85.2	0.0		1,228	87.9	0.0		111	77.9	0.0

* Standard Error (SE)

** SE = 0% because no more than one Local Road was observed per jurisdiction, thus no variability was measured.

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INTRODUCTION

The National Highway Traffic Safety Administration (NHTSA) published new Uniform Criteria for State Observational Surveys of Seat Belt Use in Federal Register Vol. 76 No. 63, April 1, 2011, Rules and Regulations, pp. 18042 – 18059. This report represents the thirteenth year of Maryland's response to the requirement to submit to NHTSA a data collection protocol and resulting observation findings of an annual State survey to estimate passenger vehicle occupant restraint use. This plan is fully compliant with the Uniform Criteria and has been used for the implementation of Maryland's 2024 seat belt survey. Using a consistent method to collect Statewide seat belt information will provide documentation for Maryland and the Nation on the success of occupant protection traffic safety programs.

Maryland is comprised of 24 jurisdictions, including 23 counties and Baltimore City; 14 of these jurisdictions account for about 86% of the passenger vehicle crash-related fatalities according to Fatality Analysis Reporting System (FARS) data averages for the period 2017 to 2019. These data contributed to the selection of roadway observation sites for use during the five-year period from 2022 to 2026 and were therefore employed to assess belt usage for this report. Road segments were mapped according to the latitude and longitude of their midpoints. A selected road segment was identified by an intersection or interchange that occurred within or just beyond the segment. If no intersection or interchange occurred within the segment, any point on that road could be used for observation. Data collection sites were selected such that traffic would be moving during the observation period. Data collection occurred as per the Site Assignment Sheets: at controlled intersections, ramps, overpasses, or on the side of the road. For interstate highways, data collection occurred on the next closest overpass. The observed direction of travel was randomly assigned for each road segment. The locations of the data collection sites were described on Site Assignment Sheets for each jurisdiction and maps were developed to aid the Data Observation Teams and Quality Control (QC) Monitors in traveling to the assigned locations.

OBJECTIVE

This research initiative used the NHTSA Uniform Criteria for State Observational Surveys of Seat Belt Use to address the following objectives for 2024:

- Develop and implement a strategic process for observing seat belt use in the State of Maryland for drivers and right front seat passengers.
- Determine the seat belt usage rate for Maryland.
- Estimate differences in passenger seat belt use for belted and unbelted drivers.
- Report driver's hand-held cell phone use.
- Develop and implement a means of Quality Control to ensure that data were collected properly following all survey protocols.

SAMPLING METHODOLOGY

Study Design

All of Maryland's 24 jurisdictions were ranked in descending order of the average number of motor vehicle crash-related fatalities for the period of 2017 to 2019 (Table 1). Data from the FARS were used to determine the average number of crash-related fatalities per jurisdiction. It was determined that 14 jurisdictions accounted for at least 85% of Maryland's total crash-related fatalities during that time period. The 85% threshold is a requirement of the NHTSA Uniform Criteria. These 14 jurisdictions comprise the sample frame (NHTSA Defined) and accounted for 86.2% of Maryland's motor vehicle crash-related fatalities as determined by FARS. The remaining 10 jurisdictions were classified as 'Non-NHTSA Defined' with limited data collection. The analyses provided in this report is limited to seat belt usage by drivers and right front seat passengers observed within the 14 NHTSA Defined jurisdictions.

Table 1 - Maryland Average Motor Vehicle Crash-Related Fatalities by Jurisdiction 2017-2019

Jurisdiction	Average Fatality Counts (2017-2019)	Fatality Percentage Within Maryland	Cumulative Fatality Percentage
NHTSA Defined			
Prince George's	57.0	18.7	18.7
Baltimore County	35.3	11.6	30.2
Anne Arundel	25.0	8.2	38.4
Charles	17.0	5.6	44.0
Baltimore City	17.0	5.6	49.6
Cecil	16.3	5.3	54.9
Howard	15.0	4.9	59.8
Montgomery	14.0	4.6	64.4
Frederick	13.7	4.5	68.9
St. Mary's	12.7	4.1	73.0
Carroll	12.0	3.9	77.0
Harford	11.0	3.6	80.6
Washington	10.0	3.3	83.8
Caroline	7.3	2.4	86.2

Table 1 Continued - Maryland Average Motor Vehicle Crash-Related Fatalities by Jurisdiction 2017-2019

Jurisdiction	Average Fatality Counts (2017-2019)	Fatality Percentage Within Maryland	Cumulative Fatality Percentage
Non-NHTSA Defined			
Wicomico	6.7	2.2	88.4
Queen Anne's	5.7	1.9	90.3
Talbot	5.0	1.6	91.9
Worcester	5.0	1.6	93.6
Calvert	4.3	1.4	95.0
Allegany	4.0	1.3	96.3
Garrett	4.0	1.3	97.6
Dorchester	3.0	1.0	98.6
Somerset	2.7	0.9	99.5
Kent	1.7	0.5	100.0

Road Segment Selection

After the 14 jurisdictions were identified, and to assure sufficient sample allocation and maintenance of errors below a threshold of 2.5% as mandated by the NHTSA Uniform Criteria, site sample sizes remained at 10 road segments per jurisdiction, for a total of 140 road segments. A probability proportional to size (PPS) sample was employed to select the road segments to be used as observation sites, using segment length as the measure of size (MOS). Maryland exercised the available exclusion option and removed non-public roads, unnamed roads, unpaved roads, vehicular trails, access ramps, cul-de-sacs, traffic circles and service drives from the dataset.

Maryland employed the Topologically Integrated Geographic Encoding and Referencing (TIGER) database from the Census Bureau, as provided by NHTSA, for the selection of road segments. The Maryland Department of Transportation – State Highway Administration estimates the jurisdiction level vehicle miles traveled (VMT) for each jurisdiction by functional class. Sample proportions within each jurisdiction were based on the jurisdictional VMT estimates applied in the creation of the 2022-2026 sample and partitioned relative to the three-way functional class grouping of Primary (interstate highways), Secondary (numbered arterial roadways), and Local/City roads using the TIGER Feature Class Code (MTFCC). A listing of the sample size allocation by jurisdiction and MTFCC classification, along with partitioned VMT estimates obtained as of January 1, 2024, for use as computation weights, is displayed in Table 2.

Table 2 - Roadway Functional Strata by Jurisdiction, Road Segments Population (N), 2024 VMT, and Number of Segments Selected (n)

Jurisdiction	Segment	MTFCC Strata			
		Primary	**Secondary**	**Local**	**Total**
Anne Arundel	Frequency (N)	992	3,154	27,553	31,699
	VMT	2,987	2,480	460	5,927
	Sample (n)	5	4	1	10
Baltimore County	Frequency (N)	1,152	4,305	36,898	42,355
	VMT	4,329	3,287	651	8,267
	Sample (n)	5	4	1	10
Caroline*	Frequency (N)	0	1,549	4,124	5,673
	VMT	21	316	67	404
	Sample (n)	0	9	1	10
Carroll	Frequency (N)	13	2,384	13,429	15,826
	VMT	40	1,122	133	1,295
	Sample (n)	1	8	1	10
Cecil	Frequency (N)	131	2,061	8,815	11,007
	VMT	554	641	144	1,339
	Sample (n)	4	5	1	10
Charles	Frequency (N)	0	2,983	13,093	16,076
	VMT	0	1,192	124	1,316
	Sample (n)	0	9	1	10
Frederick	Frequency (N)	563	3,013	17,874	21,450
	VMT	1,843	1,064	326	3,233
	Sample (n)	6	3	1	10
Harford	Frequency (N)	136	2,828	12,716	15,680
	VMT	882	1,409	226	2,517
	Sample (n)	4	5	1	10
Howard	Frequency (N)	498	1,749	13,247	15,494
	VMT	2,453	1,290	357	4,100
	Sample (n)	6	3	1	10
Montgomery	Frequency (N)	929	4,602	33,277	38,808
	VMT	2,977	3,783	544	7,304
	Sample (n)	4	5	1	10
Prince George's	Frequency (N)	968	5,898	34,689	41,555
	VMT	4,548	3,787	652	8,987
	Sample (n)	5	4	1	10

*Although VMT data were reported for Primary roads in Caroline County, TIGER road segment data did not identify any road segment in the county as a Primary roadway. Thus, no Primary roads were sampled for observation in Caroline County.

Table 2 Continued - Roadway Functional Strata by Jurisdiction, Road Segments Population (N), 2024 VMT, and Number of Segments Selected (n)

Jurisdiction	Segment	MTFCC Strata			
		Primary	Secondary	Local	Total
St. Mary's	Frequency (N)	0	1,953	9,304	11,257
	VMT	0	789	122	911
	Sample (n)	0	9	1	10
Washington	Frequency (N)	502	2,576	11,132	14,210
	VMT	1,093	777	234	2,104
	Sample (n)	5	4	1	10
Baltimore City	Frequency (N)	747	2,780	25,752	29,279
	VMT	1,224	1,833	233	3,290
	Sample (n)	3	6	1	10

The jurisdictional and functional class specific proportions were merged by MTFCC (Primary, Secondary and Local) with the TIGER data containing road segments within each jurisdiction and corresponding segment length. The list of eligible road segments in each jurisdiction was then sorted by segment length within MTFCC group to obtain an ordered list. Road segments were selected within each jurisdiction and MTFCC functional class with PPS using length as the MOS. Let $c = 1,2, \ldots C$ be the jurisdiction strata, h = 1,2, …H be the MTFCC strata, v_{chi} be the length for road segment i in stratum h in jurisdiction c, and $v_{ch} = \sum_{all\ i\ in\ ch} v_{chi}$ be the total length for all road segments in stratum h within jurisdiction c. Then the road segment inclusion probability is: $\pi_{chi} = n_{ch} v_{chi} / v_{ch}$, where $n_{ch}$is the sample size for the roadway stratum h that was allocated within jurisdiction c. In Maryland, there were no roadway segments whose MOS was equal to or exceeded v_{ch}/n_{ch}; therefore, no roads were selected with certainty. SAS procedure SURVEYSELECT, with MOS and probability vector as described above, was used to obtain the road segment samples with PPS by three-way functional class grouping within each jurisdiction.

Reserve Site Selection

Maryland also identified reserve data collection sites. These sites were used in the event that a pre-identified site was unavailable due to temporary or permanent circumstances. Reserve road segments consisted of up to five additional road segments per original road segment selected, resulting in a reserve sample of 210 road segments. The reserve segments were also selected with PPS, stratifying by MTFCC within jurisdiction and using segment length as MOS; this was the same approach that was used to select all other roadway segments. Thus, for the purposes of data weighting, the reserve road segment inherited all probabilities of selection and weighting components up to and including the road segment stage of selection from the original road segments actually selected. Probabilities and weights for any subsequent stages of selection (e.g., the sampling of vehicles) were determined by the reserve road segment itself.

Table 3 outlines the survey methodology details used in Maryland in 2024.

Table 3 - Methodology Summary Chart

Methodology	Multistage Stratified Cluster Design with Probability Proportional to Size Sampling	
Sources of Samples	2022 revised methodology, approved by Maryland Highway Safety Office (MHSO) and NHTSA; 2020 TIGER data developed by the U.S. Census Bureau based on the MAF/TIGER Feature Class Code (MTFCC)	
Geographic Coverage	State of Maryland	
Site Roadway Classification	Based on the VMT estimate for each jurisdictional roadway type: Primary, Secondary, Local	
Number of Sites	*Primary*	48
	Secondary	78
	Local/City	14
	TOTAL	140
Survey Period	June 2, 2024 – June 15, 2024	
Observation Duration Per Site	*Primary*: 20-minute survey *Secondary*: 40-minute survey *Local/City*: 60-minute survey	
Sample Size	29,850 vehicles	

Sampling Weights

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

c – Subscript for jurisdiction (PSU)
h – Subscript for road segment strata
i – Subscript for road segment
j – Subscript for time segment
k – Subscript for road direction
l – Subscript for lane
m – Subscript for vehicle
n – Subscript for front seat occupant

Under this stratified multistage sample design, the inclusion probability for each observed vehicle was the product of selection probabilities at all stages: π_c for jurisdiction, $\pi_{hi|c}$ for road segment, $\pi_{j|chi}$ for time segment, $\pi_{k|chij}$ for direction, $\pi_{l|chij}$ for lane, and $\pi_{m|chijl}$for vehicle. The overall vehicle inclusion probability was:

$$\pi_{chijklm} = \pi_c \pi_{hi|c} \pi_{j|chi} \pi_{k|chij} \pi_{l|chij} \pi_{m|chijl}.$$

The sampling weight (design weight) for vehicle *m* was:

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

Non-response Adjustment

Given the data collection protocol described in this plan, including the provision for the use of alternate observation sites, road segments with nonzero eligible volume and yet zero observations conducted should be a rare event. 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, then this site was considered as a "non-responding site." The weight for a non-responding site was distributed over other sites in the same road type in the same PSU.

Let:

$$\pi_{chi} = \pi_c \pi_{hi|c}$$

be the road segment selection probability, and

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

be the road segment weight. The non-responding site non-response adjustment factor

$$f_{ch} = \frac{\sum_{all\ i} w_{chi}}{\sum_{responding\ i} w_{chi}}$$

would be multiplied by all weights of non-missing road segments of the same road type in the same jurisdiction and the missing road segments would be dropped from the analysis file. However, if no vehicles passed the site during the selected observation time (either 20, 40 or 60 minutes), then this site was simply an empty block; the site would not be considered as a non-responding site and would not require non-response adjustment.

Estimators

Noting that all front seat occupants were observed, let the driver/passenger seat belt use status be:

$$y_{chijklmn} = \begin{cases} 1, & if\ belt\ used \\ 0, & otherwise \end{cases}.$$

VMT data were available for Maryland jurisdictions at the functional class level. Hence, the seat belt use rate estimator was a ratio estimator with VMT weights:

$$p_{VMT} = \frac{\sum_c \sum_h VMT_{ch} p_{chi}}{\sum_c \sum_h VMT_{ch}}.$$

Here VMT_{ch} is the VMT for functional class h in jurisdiction c. Assuming that all vehicles observed at the same road segment i have equal probability for being selected, then the road segment level seat belt use rate p_{chi} can be reduced to the following:

$$p_{chi} = \frac{\sum_{all\ i\ in\ ch} w_{chi} y_{chijklmn}}{\sum_{all\ i\ in\ chi} w_{chi}}.$$

where w_{chi} is the road segment selection weight.

Sample Size

A standard error of less than 2.5% for the seat belt use estimates is required by NHTSA Uniform Criteria. From 1999-2011, Maryland conducted the Annual Seat Belt Use Study and historically obtained standard errors well below this threshold (e.g., 0.4%, 0.4% and 0.5% in the most recent three years) via observed sample sizes of approximately 58,000-73,000 motor vehicle front seat occupants. These observed sample sizes were obtained from previous sample designs using 12 jurisdictions and 1-16 road segments per jurisdiction. The roadway set was revised in 2012, five years later in 2017, and again in 2022, as required by the Uniform Criteria. From 2017 to 2021, the average annual number of observed occupants with known seat belt use hovered just below 47,000, with an average standard error of 0.7%. In 2023, 33,882 front seat occupants with known belt use were observed with a standard error of 0.9%. Thus, the sample size with known belt use for the 2024 seat belt use survey sample was projected to be approximately 35,000 occupants.

DATA COLLECTION

Data Collection Team Training and Quality Control

In FFY2024, the NSC conducted in-person training sessions for the Data Collection Teams and Quality Control monitors. The training PowerPoint presentation included an interactive classroom period describing the observation process and a tutorial detailing the use of an iPad to collect data in the field. Each observer was provided a training manual containing a description of data collection techniques and GPS locations of all observation sites. Training also consisted of an outdoor session, where each counter was provided the opportunity to perform the Data Observer and Data Recorder roles while using the iPads. Quality control site visits were conducted by NSC and MHSO staff during the observation period.

Data Collection Teams

The NSC staff members and hired college students conducted the data collection. Each Data Collection Team (DCT) was comprised of a Data Observer and a Data Recorder. The Data Observer was responsible for observing the flow of traffic and spotting, or calling out, vehicle seat belt observation information. The Data Recorder was responsible for recording the data as observed on the iPad. Observation at each site was conducted by a complete DCT consisting of both members.

Data Collection Lanes

Before starting the actual data collection at a particular site or Observation Post, the DCT determined, through observation, the traffic flow and number of lanes that could be observed without error. The Data Observer observed, at a minimum, the right-most lane on the roadway. If traffic was light enough to survey an additional lane(s), the team may have done so, provided that 100% of the traffic in the observed lanes was recorded for the duration of the survey at that site. Each DCT was requested to observe more than one lane when possible.

Only one direction of traffic was observed at any given site unless otherwise noted on the Site Assignment Sheet (pre-determined roads may have required observation in both directions of travel). The direction of travel was pre-determined and identified on the Site Assignment Sheet. If an intersection contained a turning lane, the DCT was instructed to strategically move its location so that the traffic in the turning lane could be included in the count. Should the site not allow for the collection team to move due to safety concerns, the DCT observed both the turn lane and the next right-most lane.

Vehicles and Occupants

Directions given to the DCT to observe belt usage included:

- Stand on the right-hand curb or roadside of the selected roadway as directed on the Site Assignment Sheet
- Face the assigned direction of traffic
- Never stand in any traffic lane
- Look for the vehicle “B-pillar,” integrated seat belt or seat back mount to determine if the belt is being utilized.

All passenger vehicles with a gross vehicle weight up to 10,000 pounds were observed in the survey. The target population included all drivers and right front seat passengers.

The only right front seat occupants excluded from this study were child passengers who were traveling in child passenger safety seats with harness straps. If a child in the right front seat was in a child passenger safety seat, the DCT did not record anything, treating the observation as if that seat was empty. If there was more than one front seat passenger, only the driver and the outboard passenger seating positions were observed.

If the vehicle was equipped with shoulder belts, but they appeared to be improperly used, the person was considered to be NOT belted.

Unknowns

Maryland developed a structure for the inclusion of unknowns in its observation counts. Data Observers and Recorders were instructed to report known belt use only if they were absolutely sure that the occupant was or was not wearing his/her seat belt; otherwise, belt use was to be reported as unknown. Unknowns included any individual in the front seat of a motor vehicle who could not be identified as being properly or improperly restrained.

Classic cars were counted only if the DCT could directly observe the use of a lap belt, as these vehicles were manufactured prior to the legislative mandate requiring vehicles to have both lap and shoulder belt harness systems. If the lap belt could not be seen, these vehicles were excluded and not documented as unknowns.

Site Locations

Maps displaying the locations of all observation sites, known as Site Assignment Sheets, were emailed to each DCT and Quality Control (QC) Monitor for use in the field. A Site Assignment Sheet was created for each jurisdictional Site Set with an overview of all five sites within that set. Site Assignment Sheets indicated the observed road name, the crossroad included within the road segment (or nearest crossroad), assigned date, assigned time, and written directions. A detailed map was included for the observation teams, marking the Observation Post and the direction of traffic to be observed. In addition, each DCT was provided with XY coordinates indicating where to stand to conduct the observations.

Sites within relatively close geographic proximity were assigned as data collection clusters (Site Set). Each data collection cluster was assigned a random day of the week and a random time (between 7 am – 7pm) for completion. The observation schedule included the day and the time. If the observation day was Monday and scheduled time was 7 am then the first site was assigned at 7 am and the other sites within the cluster were assigned to minimize travel distance between sites.

Scheduling and Rescheduling

All seat belt observations were conducted during daylight hours. The schedule included rush hour (before 9:30 AM, after 3:30 PM) and non-rush hour observation times. It was anticipated that fewer than 60 minutes of observation would provide sufficient sample sizes for highways and arterial roads. Thus, data collection was conducted for 20 minutes (Primary), 40 minutes (Secondary), or 60 minutes (Local) at each site, depending on the road classification. Multiple sites were scheduled each day. In 2024, the observations were conducted beginning Sunday, June 2nd through Saturday, June 15th, with several sites rescheduled for the following week due to adverse weather conditions and temporary construction. Following data collection and an examination of the belt usage and unknown belt use

rates, seven site sets containing roadways with unknown rates above 30% were recounted in late August and early September.

Data Collection on the iPad

Seat Belt Data Collection Form

Upon arrival at the designated observation site, each DCT was required to log into their iPad, open the data collection app and tap the Seat Belt Data Collection Form. The top of the Seat Belt Data Collection Form located on the iPad is designed to allow for documentation of descriptive site information, such as date, site location, jurisdiction, start and end times for observations, and weather conditions. It was completed once by the Data Recorder at each site before data collection began.

The bottom of the form contains fields that were filled in when vehicle observation began. As each vehicle passed, the Data Recorder selected the applicable option (Yes/No/Unknown) for the "Driver Belted" and "Passenger Belted" fields. In addition, the "Cellphone" box was marked if the driver was observed using a handheld device while driving. Pick-up Trucks were indicated by tapping the "Truck" field. Finally, by clicking the "Submit" button, the record was entered into the iPad record list and the fields were cleared for the next observed vehicle.

Seat Belt Comment Form

Once observation was completed at the site, the DCT was asked to fill out the Seatbelt Comment Form on the iPad. This document was used to record the number of lanes observed, whether the site was observed for its entirety at the scheduled time, and any concerns or challenges the team had while completing the survey at that site.

Quality Control

QC Monitors filled out QC forms and sent them to the NSC for review upon the completion of the site visit. During these visits, the QC Monitors used standardized paper forms to document and evaluate Maryland's process.

Data Cleaning and Aggregation

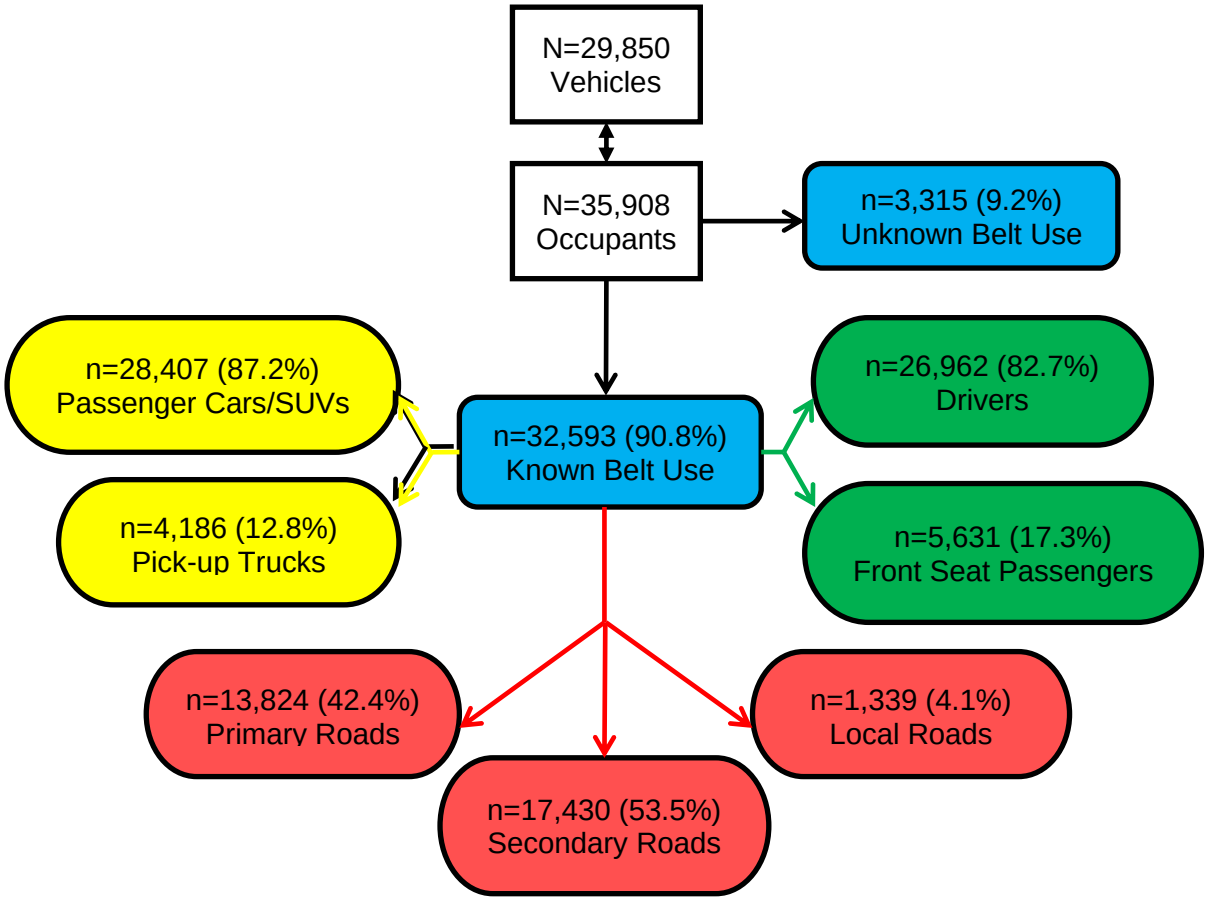
Upon completion of collecting data from site locations, the DCT was responsible for assuring that the iPad containing the collected data was submitted to the NSC in a timely manner. Once all iPads were received at the NSC, data from each individual iPad were downloaded and checked for accuracy and consistency. Records with unknown values were examined for possible correction or deletion. For instance, submitted records that were completely blanked were excluded from the data set. The resulting record-level data were aggregated into .CSV files for formal analysis.

RESULTS

NHTSA Sites – Occupants

A total of 29,850 motor vehicles (i.e., passenger cars, sport utility vehicles (SUVs), and pick-up trucks) with 35,908 front seat occupants were observed within the 14 sampled jurisdictions (Figure 1). These totals represented increases of 3.6% in the number of motor vehicles and 1.5% in the number of front seat occupants observed in the 2023 survey. Known seat belt use was ascertained for 32,593 (90.8%) of the occupants, of whom 26,962 (82.7%) were drivers and 5,631 (17.3%) were right front seat passengers.

Figure 1 – Study Population
Flowchart of Vehicle and Occupant Observations



Of the 32,593 drivers and right front seat passengers with known seat belt usage, 28,407 (87.2%) were occupants of passenger cars or SUVs and 4,186 (12.8%) were occupants of pick-up trucks. Most of the 32,593 occupants were observed on arterial Secondary roadways (n=17,430, 53.5%) as opposed to Interstate/Primary roads (n=13,824, 42.4%) or Local roads (n=1,339, 4.1%).

Data collection by jurisdiction (Table 4) indicated that the largest number of occupants with known belt use were observed in Anne Arundel (n=3,721) and the fewest were observed in Caroll County (n=1,279). The average number of occupants observed per jurisdiction with known seat belt usage was 2,238.

Table 4 – Number of Front Seat Occupants Observed With Known Seat Belt Use by NHTSA-Surveyed Jurisdiction of Maryland

Jurisdiction	Number Observed
Anne Arundel	3,721
Charles	3,159
Prince George's	3,000
Baltimore City	2,554
Cecil	2,474
Howard	2,466
Harford	2,385
Frederick	2,337
Baltimore Co	2,141
Montgomery	2,015
Washington	1,945
St. Mary's	1,781
Caroline	1,336
Carroll	1,279

NHTSA Sites – Weighted Analysis

The overall seat belt usage rate among the 14 sampled jurisdictions for all drivers and right front seat passengers, weighted by probability of roadway selection and jurisdictional roadway specific VMT, was 90.6% (Table 5, Figure 2). Weighted usage rates were higher for occupants of passenger cars or SUVs (91.7%) than for occupants of pick-up trucks (82.6%). The overall weighted standard error rate of 0.9% was well below the 2.5% threshold required by NHTSA, yielding a 95% confidence interval of 88.8% to 92.4% for the combined usage rate. Relative to the data collected for passenger cars, the standard error rate for pick-up trucks was higher (2.2% vs. 0.8%) but was still below the 2.5% NHTSA limit.

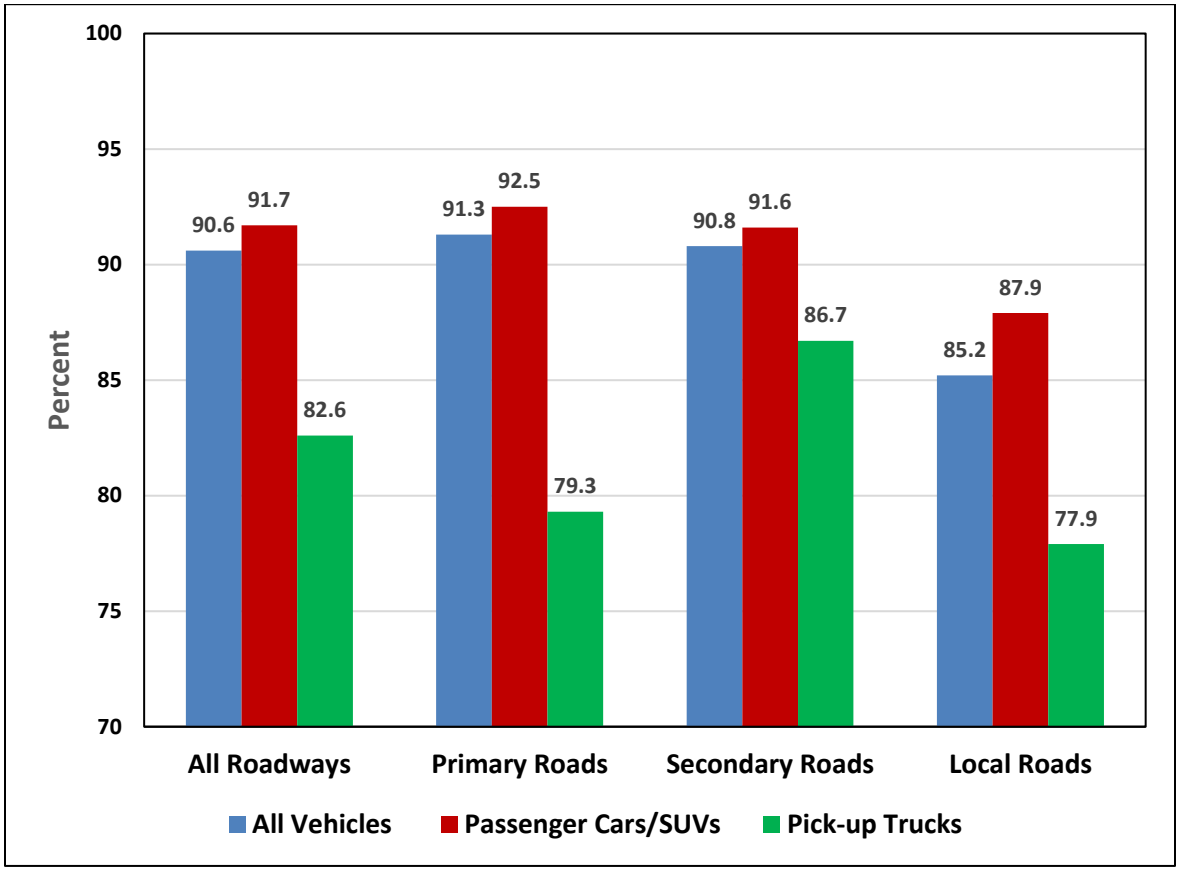
Vehicle occupants were more likely to use seat belts on Interstate/Primary roadways as opposed to Secondary roads and Local roads. Approximately 91.3% of drivers and passengers observed on Primary roadways were belted. This proportion fell to 90.8% on Secondary roads and 85.2% on Local roads. Front seat occupants of passenger cars or SUVs had higher rates than corresponding occupants of pick-up trucks on Primary roads (92.5% vs. 79.3%, respectively), Secondary roads (91.6% vs. 86.7%), and Local roads (87.9% vs. 77.9%).

Table 5 – 2024 Weighted Usage Rates in NHTSA-Surveyed Jurisdictions of Maryland Overall, by Vehicle Type and by Roadway
All Front Seat Occupants Combined With Known Seat Belt Use

All Vehicles					
				95% CI	
	N	**Usage Rate (%)**	**SE (%)**	**Lower Limit (%)**	**Upper Limit (%)**
All Roadways	32,593	90.6	0.9	88.8	92.4
Primary Roads	13,824	91.3	1.0	89.3	93.3
Secondary Roads	17,430	90.8	0.9	89.0	92.6
Local Roads*	1,339	85.2	0.0	N/A	N/A
Passenger Cars/SUVs					
				95% CI	
	N	**Usage Rate (%)**	**SE (%)**	**Lower Limit (%)**	**Upper Limit (%)**
All Roadways	28,407	91.7	0.8	90.1	93.3
Primary Roads	12,279	92.5	0.9	90.7	94.3
Secondary Roads	14,900	91.6	0.9	89.8	93.4
Local Roads*	1228	87.9	0.0	N/A	N/A
Pick-up Trucks					
				95% CI	
	N	**Usage Rate (%)**	**SE (%)**	**Lower Limit (%)**	**Upper Limit (%)**
All Roadways	4,186	82.6	2.2	78.3	86.9
Primary Roads	1,545	79.3	3.0	73.4	85.2
Secondary Roads	2,530	86.7	1.9	83.0	90.4
Local Roads*	111	77.9	0.0	N/A	N/A

*Standard Error = 0% because no more than 1 Local Road was observed per jurisdiction, thus no variability was measured.

Figure 2 - Usage Rate by Vehicle Type and Roadway Following Adjustment for Probability of Road Segment Selection and Vehicle Miles Traveled (VMT)



The 2024 Maryland weighted seat belt usage rate decreased by 1.5 percentage points over the previous year (Table 6 and Figures 3 and 4). The 2024 rates were lower than 2023 rates in all but one area: All vehicles, Cars/SUVs, Trucks, Primary Roads, Secondary Roads. The only improvement was in Local Roads.

Table 6- Change From 2022 to 2024 in Weighted Seat Belt Usage by Vehicle Type & Roadway

	2022	2023	2024	Change in Rate 2023-2024	Change in Rate 2022-2024
All Vehicles	92.7	92.1	90.6	-1.5	-2.1
Cars/SUVs	93.4	92.6	91.7	-0.9	-1.7
Trucks	88.0	89.0	82.6	-6.4	-5.4
Primary Roads	95.2	93.6	91.3	-2.3	-3.9
Secondary Roads	91.8	92.6	90.8	-1.8	-1.0
Local Roads	85.2	81.3	85.2	3.9	0

Figure 3 – Comparison from 2022 to 2024 of Weighted Seat Belt Usage Rates by Vehicle Type

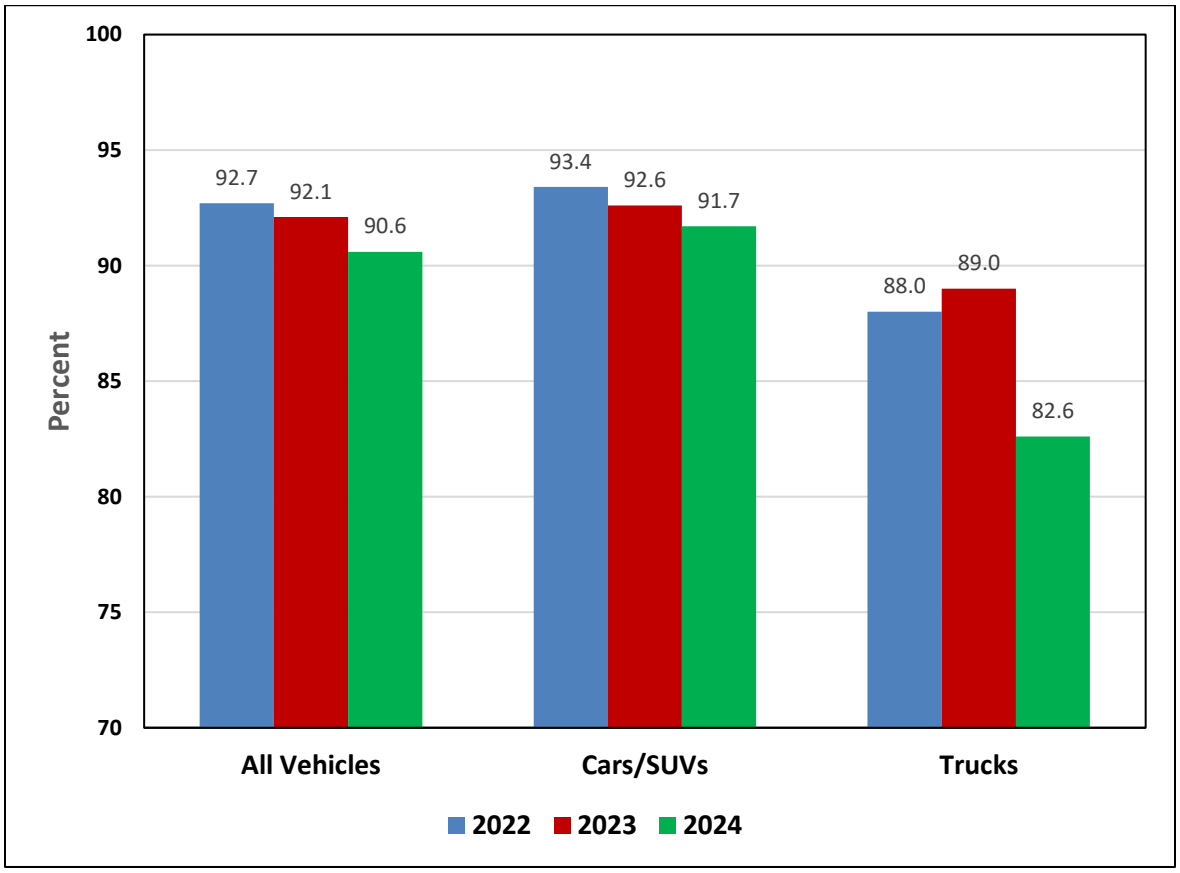
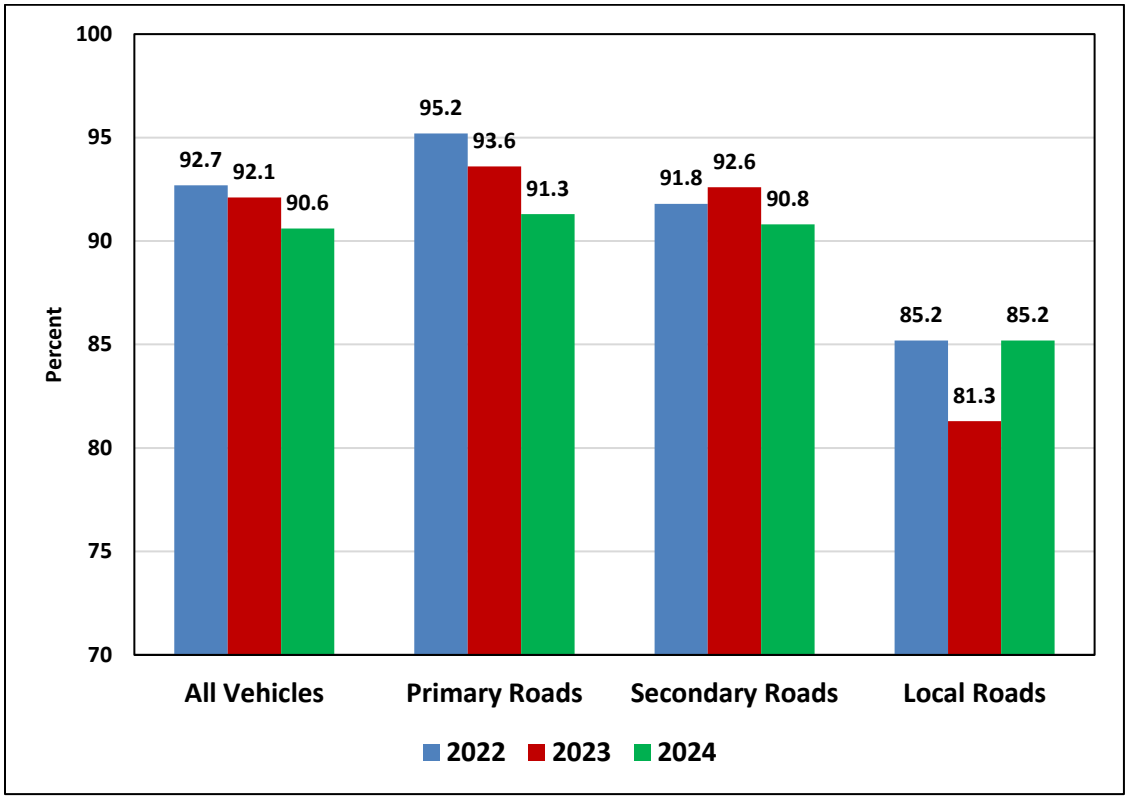


Table 7 contains a list of weighted belt use and standard error rates by jurisdiction for all vehicles combined. Nine (64.3%) of the 14 jurisdictions had seat belt usage rates of at least 90%. The highest seat belt usage rates were found in Cecil County (98.0%), Harford County

(97.0%) and Washington County (94.8%), while St. Mary's (87.3%), Anne Arundel (86.9%) and Baltimore Co (86.7%) counties had the three lowest rates.

Figure 4 - Comparison from 2022 to 2024 of Weighted Seat Belt Usage Rates by Roadway Type



Jurisdictional usage rates of occupants observed in passenger cars or SUVs were also at least 90% in eleven (78.6%) of the 14 jurisdictions (see Table 7). Cecil (98.2%), Harford (97.5%) and Washington (95.4%) counties had the highest usage rates among occupants of cars/SUVs, while Anne Arundel (89.2%), Prince George's (88.9%) and Baltimore County (87.7%) had the lowest rates.

For occupants of pick-up trucks, five (35.7%) of the 14 jurisdictions had usage rates above 90%. The highest rates were found in Cecil (96.0%), Montgomery (94.8%) and Harford (94.5%) counties (see Table 7). Overall, there were four jurisdictions with rates between 80% and 90%, and five counties below 80%. A color-coded map of weighted rates by NHTSA jurisdiction is displayed in Figure A of the Appendix.

Table 7
2024 Weighted Usage Rates in NHTSA-Surveyed Jurisdictions of Maryland
by Jurisdiction and Vehicle Type
All Front Seat Occupants Combined With Known Seat Belt Use

		All Vehicles			Passenger Cars/SUVs			Pick-up Trucks	
	VMT (millions)	Usage Rate*	SE		Usage Rate	SE		Usage Rate	SE
All 14 Jurisdictions	50,358	90.6	0.9		91.7	0.8		82.6	2.2
Cecil	1,300	98.0	0.2		98.2	0.2		96.0	0.5
Harford	2,517	97.0	0.2		97.5	0.1		94.5	0.9
Washington	2,047	94.8	0.3		95.4	0.4		92.3	1.3
Charles	1,264	94.1	0.7		94.2	0.8		93.5	1.2
Montgomery	7,206	93.9	0.9		94.1	0.9		94.8	2.8
Howard	4,084	93.1	0.4		94.3	0.4		69.0	5.1
Carroll	1,264	92.9	0.5		94.2	0.4		84.8	1.8
Frederick	3,158	91.4	0.8		94.5	0.7		78.6	1.2
Baltimore City	3,242	90.6	0.7		91.2	1.0		86.7	1.8
Caroline	384	89.1	0.6		90.6	0.5		84.9	1.2
Prince George's	8,952	88.0	0.8		88.9	0.8		80.4	1.3
St. Mary's	884	87.3	0.6		90.6	0.4		77.9	1.0
Anne Arundel	5,899	86.9	0.6		89.2	0.6		75.0	0.9
Baltimore Co	8,157	86.7	2.1		87.7	1.8		76.8	4.1

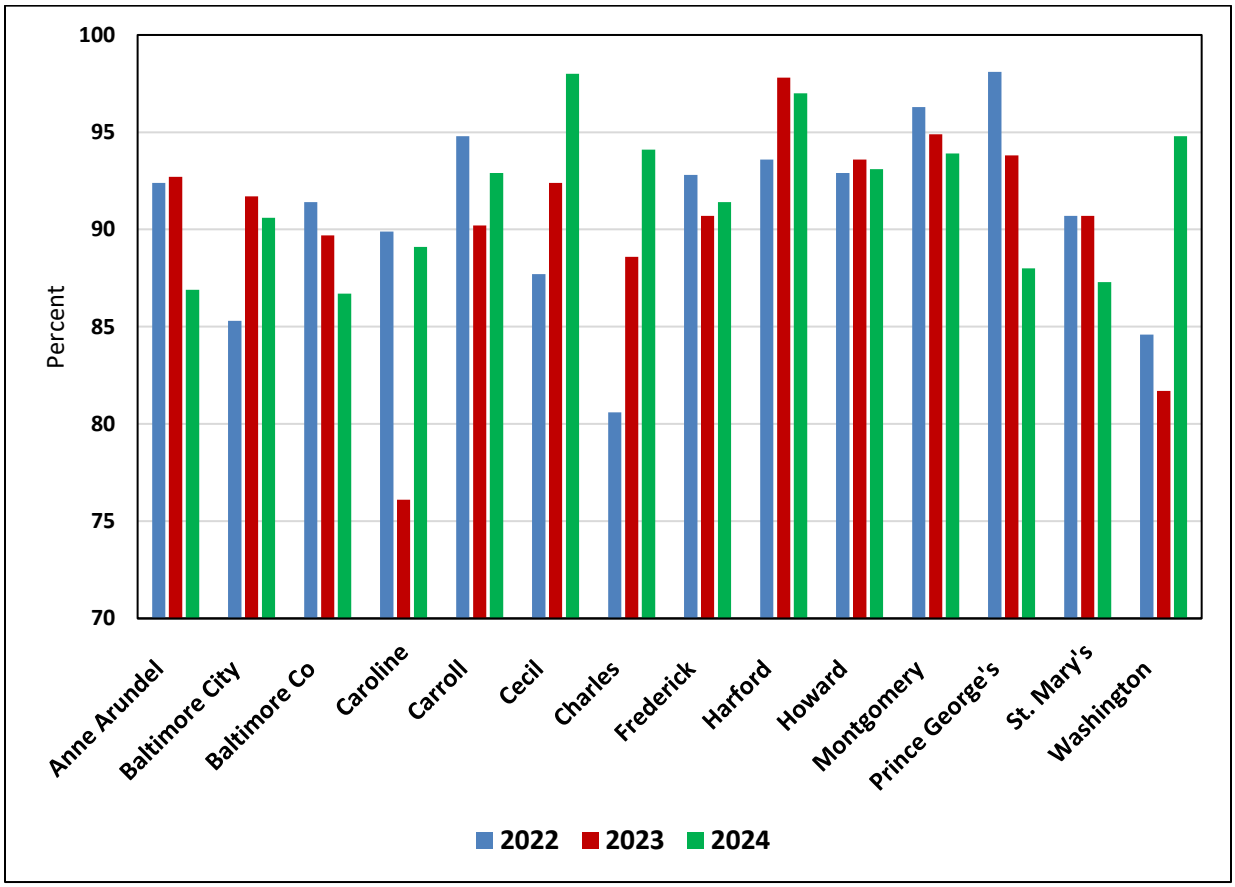
* Jurisdictional usage rates are sorted in descending order for all vehicles combined.

Jurisdictional changes in weighted rates over time are documented in Table 8 and Figure 5. Six (42.9%) of the 14 jurisdictions experienced an increase in usage rate over the previous year, with Washington County (+13.1 percentage points) and Caroline County (+13.0) experiencing the biggest gains. The largest declines occurred in Prince George's and Anne Arundel (-5.8). Overall, two jurisdictions had a rate that was consistently higher than the previous year since 2022 (Cecil and Charles).

Table 8 - Changes Between 2022 and 2024 in Weighted Seat Belt Usage by Jurisdiction

Jurisdiction	2022	2023	2024	Change in Rate 2023-2024	Change in Rate 2022-2024
All Jurisdictions	92.7	92.1	90.6	-1.5	-2.1
Anne Arundel	92.4	92.7	86.9	-5.8	-5.5
Baltimore City	85.3	91.7	90.6	-1.1	5.3
Baltimore Co	91.4	89.7	86.7	-3.0	-4.7
Caroline	89.9	76.1	89.1	13.0	-0.8
Carroll	94.8	90.2	92.9	2.7	-1.9
Cecil	87.7	92.4	98.0	5.6	10.3
Charles	80.6	88.6	94.1	5.5	13.5
Frederick	92.8	90.7	91.4	0.7	-1.4
Harford	93.6	97.8	97.0	-0.8	3.4
Howard	92.9	93.6	93.1	-0.5	0.2
Montgomery	96.3	94.9	93.9	-1.0	-2.4
Prince George's	98.1	93.8	88.0	-5.8	-10.1
St. Mary's	90.7	90.7	87.3	-3.4	-3.4
Washington	84.6	81.7	94.8	13.1	10.2

Figure 5 - Comparison from 2022 to 2024 of Weighted Seat Belt Usage Rates by Jurisdiction



NHTSA Sites – Unweighted Analysis

An unweighted analysis of seat belt rates was conducted for subgroups of the observed sample that were not examined by probability of selection and VMT weights. These subgroups included drivers only, passengers only, and jurisdiction-specific roadway types.

Approximately 92.3% of all drivers were belted (Table 9). Belt use among drivers was more likely to occur in passenger cars or SUVs (93.4%) than in pick-up trucks (85.3%). Drivers were more likely to be belted on Primary roads (92.7%) than on Secondary roads (92.1%) or Local roads (91.2%).

A lower proportion of passengers than drivers were belted overall (91.7%). As for drivers, passengers had a higher usage rate in passenger cars/SUVs (92.8%) than in trucks (84.1%). Passengers were more likely to be belted on Primary roads (92.5%) than on Secondary (90.8%) but not on Local roads (95.9%).

Table 9 - 2024 Unweighted Usage Rates in NHTSA-Surveyed Jurisdictions of Maryland
Overall, by Vehicle Type and by Roadway Classification
Known Seat Belt Use by Front Seat Occupant Status

	All Vehicles			Passenger Cars/SUVs			Pick-up Trucks	
	N	Usage Rate (%)		N	Usage Rate (%)		N	Usage Rate (%)
DRIVERS Only								
All Roadways	26,962	92.3		23,494	93.4		3,468	85.3
Primary Roads	11,284	92.7		9,986	93.7		1,298	85.1
Secondary Roads	14,509	92.1		12,438	93.2		2,071	85.6
Local Roads	1,169	91.2		1,070	92.1		99	80.8
PASSENGERS Only								
All Roadways	5,631	91.7		4,913	92.8		718	84.1
Primary Roads	2,540	92.5		2,293	93.3		247	85.0
Secondary Roads	2,921	90.8		2,462	92.1		459	83.7
Local Roads	170	95.9		158	96.8		12	83.3

Seat belt usage rates by jurisdiction are presented on Table 10. In a few cases on Local roads no trucks were observed so the usage rate cannot be calculated (N/A).

Table 10 – 2024 Unweighted Usage Rates in NHTSA-Surveyed Jurisdictions of Maryland by Vehicle Type and Roadway Classification Within Jurisdiction
All Front Seat Occupants Combined With Known Seat Belt Use

Jurisdiction	# of Sites	Roadway Classification	Unweighted Seat Belt Usage Rates (%)		
			All Vehicles	Passenger Cars/SUVs	Pick-up Trucks
Anne Arundel	5	Primary	86.4	88.0	77.1
Anne Arundel	4	Secondary	89.6	91.9	78.4
Anne Arundel	1	Local	81.8	85.1	62.5
Baltimore City	3	Primary	94.3	94.9	89.7
Baltimore City	6	Secondary	86.2	86.3	85.5
Baltimore City	1	Local	92.4	92.4	92.3
Baltimore Co	5	Primary	90.2	91.3	77.8
Baltimore Co	4	Secondary	81.9	83.8	68.4
Baltimore Co	1	Local	65.0	64.3	66.7
Caroline	9	Secondary	87.2	89.4	80.4
Caroline	1	Local	88.4	90.6	81.8
Carroll	1	Primary	92.2	91.2	96.8
Carroll	8	Secondary	90.7	92.6	82.3
Carroll	1	Local	96.9	96.7	100.0
Cecil	4	Primary	98.8	99.2	94.4
Cecil	5	Secondary	96.8	97.1	94.9
Cecil	1	Local	100.0	100.0	100.0
Charles	9	Secondary	98.7	98.8	97.6
Charles	1	Local	87.5	87.5	N/A
Frederick	6	Primary	93.2	93.8	87.2
Frederick	3	Secondary	92.3	92.7	88.5
Frederick	1	Local	75.0	100.0	N/A

Table 10 Continued
2024 Unweighted Usage Rates in NHTSA-Surveyed Jurisdictions of Maryland by Vehicle Type and Roadway Classification Within Jurisdiction
All Front Seat Occupants Combined With Known Seat Belt Use

Jurisdiction	# of Sites	Roadway Classification	Unweighted Seat Belt Usage Rates (%)		
			All Vehicles	Passenger Cars/SUVs	Pick-up Trucks
Harford	4	Primary	96.8	96.9	96.4
Harford	5	Secondary	96.5	97.4	91.7
Harford	1	Local	97.4	100.0	88.9
Howard	6	Primary	93.5	94.6	85.7
Howard	3	Secondary	97.4	97.5	96.3
Howard	1	Local	91.4	95.7	75.7
Montgomery	4	Primary	94.4	95.3	83.1
Montgomery	5	Secondary	93.8	94.0	91.5
Montgomery	1	Local	96.2	96.1	100.0
Prince George's	5	Primary	88.8	90.2	78.6
Prince George's	4	Secondary	86.9	87.4	79.5
Prince George's	1	Local	83.1	82.1	100.0
St. Mary's	9	Secondary	88.5	91.6	80.0
St. Mary's	1	Local	78.9	86.7	50.0
Washington	5	Primary	95.6	96.5	90.4
Washington	4	Secondary	93.0	94.3	85.9
Washington	1	Local	100.0	100.0	100.0

NHTSA Sites – Unknown Observations

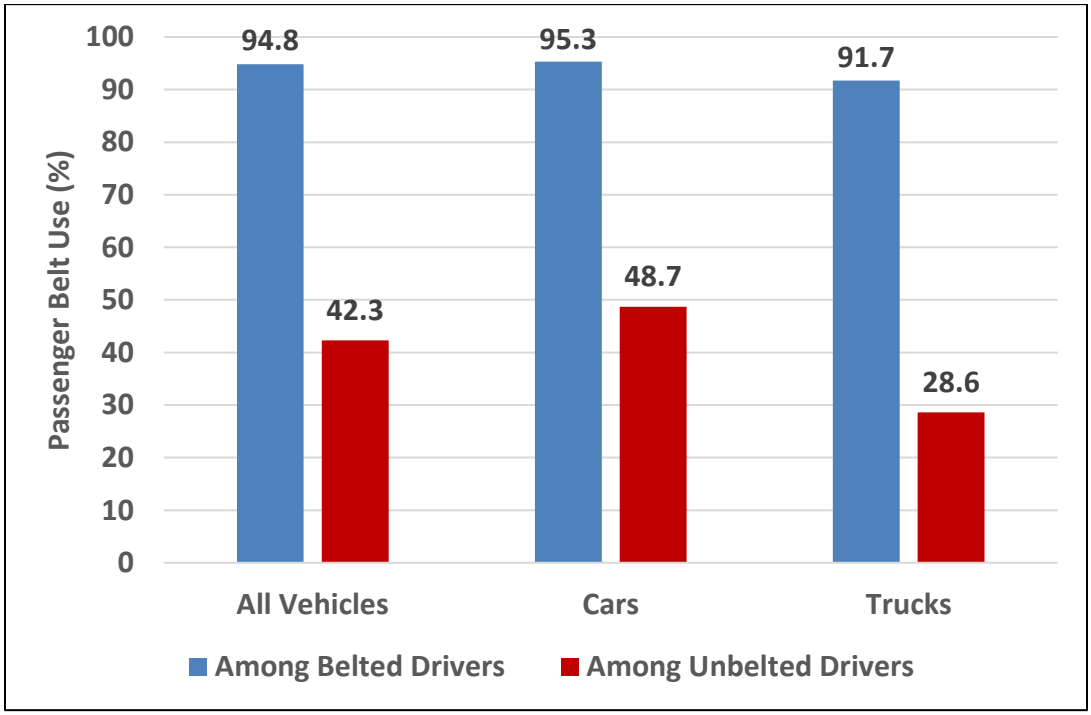
Seat belt usage could not be determined for 9.2% of all front-seat occupants, differing between drivers (9.7%) and passengers (7.1%). Unknown belt use was more prevalent in pick-up trucks (15.0%) than in passenger cars (8.3%) and lower on Secondary roads (8.4%) than on Primary (10.0%) or Local roads (12.2%). Unknown observations were primarily attributed to glare (caused by bright sunny skies), extensive window tinting, and light rain.

Analysis of Individual Record-Level Data

In addition to the analysis of summary data to calculate overall usage rates, individual record-level data were analyzed for more in-depth study of occupant behavior within NHTSA jurisdictions. Specific analyses focused on the unweighted belt use of the right front passenger and their association with the driver's unweighted belt use, as well as any connection between unweighted driver belt use and observed hand-held cell phone use. However, because this project is primarily a study of seat belt usage, the cell phone results should not be viewed as being conclusive. Less than ideal observation angles (e.g., from an overpass), glare, and concentration on determining seat belt usage may have contributed to an underestimate of cell phone usage.

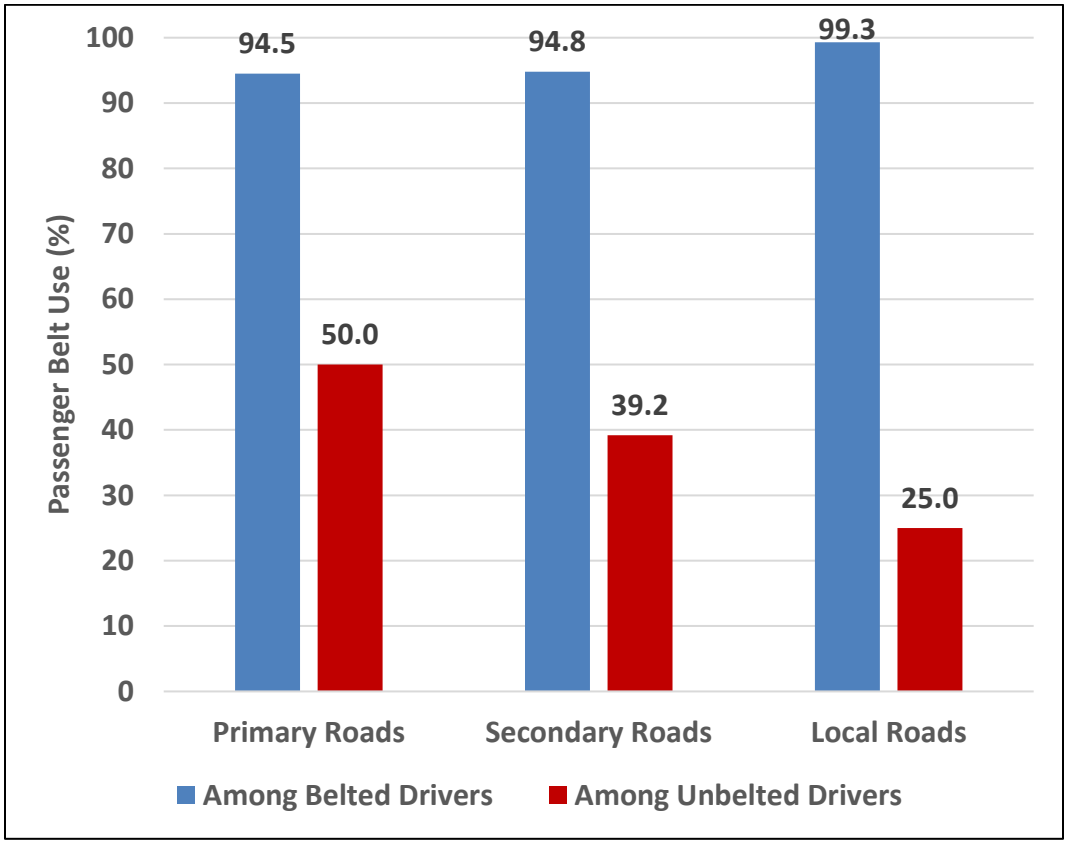
Of the 26,962 belted and unbelted drivers observed in NHTSA jurisdictions, approximately 20.9% (n=5,631) also had a passenger observed in the right front seating position. Approximately 92.3% of those drivers were belted and the majority were riding in cars (87.1%). Of the drivers that were belted with passengers in the vehicle, 94.8% of their passengers were also belted. However, among the cases of unbelted drivers with passengers, only 42.3% of the passengers were belted. This large difference was also prevalent when the data were stratified by vehicle type: 95.3% vs. 48.7% of passengers wore their seat belt in cars with belted and unbelted drivers, respectively, while 91.7% vs. 28.6% of passengers were belted in pick-up trucks with belted and unbelted drivers (Figure 7).

Figure 7 – 2024 Right Front Passenger Seat Belt Use is Associated With Driver Use by Vehicle Type



The associations of lower passenger belt use with unbelted drivers, and the larger difference among those in pickup trucks as compared to cars, were also present when examining the data by roadway classification (Figure 8). The overall difference in passenger belt use between cases of belted and unbelted drivers was 94.5% vs. 50.0% on Primary roads, 94.8% vs. 39.2% on Secondary roads, and 99.3% vs. 25.0% on Local roads. Thus, the large difference in passenger restraint by driver restraint use that was observed on Primary roads was even wider on Secondary and Local roadways.

Figure 8 – 2024 Right Front Passenger Seat Belt Use is Associated With Driver Use by Roadway Classification



The data were further analyzed with regard to observed hand-held cell phone use among drivers. A total of 905 (3.4% of all drivers) were observed using a hand-held cellphone while operating a vehicle.

SUMMARY

The overall observed seat belt usage rate for drivers and right front seat passengers observed in the State of Maryland in June 2024, after weighting by probability of roadway selection and jurisdictional roadway specific VMT, was 90.6%. The 2024 usage rate represented a 1.5 percentage point decrease from the previous year. The Statewide standard error of 0.9% was well below the NHTSA threshold of 2.5%, yielding a 95% confidence interval of 88.8% to 92.4% for the combined usage rate. These rates were based on observation of 29,850 vehicles and 35,908 occupants, representing increases of 3.6% and 1.5% in the number of vehicles and occupants observed, respectively, in the 2024 survey.

Belt use was highest among passenger cars and SUVs relative to pick-up trucks (91.7% vs. 82.6%, respectively). Seat belt usage was also highest among all front seat occupants traveling on Primary roads relative to Secondary and Local roads (91.3% vs. 90.8% and 85.2%.

The biggest single decrease in the seat belt usage rate in 2024 was for pick-up trucks with 6.4 percentage points decrease compared to 2023 rate and 5.4 percentage points decrease compared to 2022 rate. This is a persistent problem and further investigation is recommended.

Cecil (98.0%) had the highest usage rate among Maryland's 14 NHTSA jurisdictions, followed by Harford (97.0%), and Washington (94.8%) counties. There were nine jurisdictions with combined rates of at least 90%; St. Mary's (87.3%), Anne Arundel (86.9%) and Baltimore Co (86.7%) counties experienced the lowest rates. Overall, six of the 14 jurisdictions experienced an increase in combined usage rates over the past year. For occupants of passenger cars or SUVs, eleven jurisdictions had usage rates of at least 90%. Among occupants of pick-up trucks, five jurisdictions had a usage rate above 90% and five jurisdictions experienced rates below 80%. Unweighted analysis indicated that drivers had a slightly higher Statewide usage rate (92.3%) than front seat passengers (91.7%).

Seat belt usage could not be ascertained for 9.2% of all drivers and passengers. Unknown belt use was more prevalent in pick-up trucks (15.0%) than in passenger cars (8.3%), higher for drivers (9.7%) than for passengers (7.1%), and lower on Secondary roads (8.4%) compared to Primary roads (10.0%) and Local roads (12.2%).

Examination of individual record-level data, for the instance in which both a driver and passenger were observed in the front seat, indicated that 94.8% of passengers were belted when the driver was belted. However, if the driver was unbelted, only 42.3% of passengers were observed to wear their belt. This large difference in passenger belt use occurred in cars and SUVs (95.3% for belted drivers vs. 48.7% for unbelted drivers) as well as in trucks (91.7% for belted drivers vs. 28.6% for unbelted drivers). There was also an association with roadway classification, with the Secondary or Local roadways corresponding to a larger difference in passenger belt use between belted and unbelted drivers than the discrepancy seen on Primary roads.

Appendix

Figure A

Maryland Seat Belt Usage Rates for NHTSA Jurisdictions 2024